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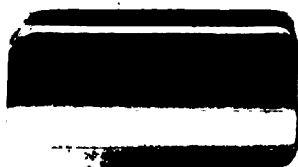
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DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF MANUFACTURES

SPECIAL AGENTS SERIES

Nos. 45-57, 59



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III

DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF MANUFACTURES
A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 45

TRADE DEVELOPMENT IN LATIN AMERICA

By

JOHN M. TURNER

Commercial Agent of the Department of Commerce and Labor

TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF JUNE 17, 1910, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD



WASHINGTON
GOVERNMENT PRINTING OFFICE
1911

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LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, March 20, 1911.

SIR: I have the honor to submit herewith for transmission to Congress a report by Commercial Agent John M. Turner on trade development in Latin America, embracing the results of his investigations in the West Indies and South America.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

To Hon. CHARLES NAGEL,
Secretary of Commerce and Labor.

LETTER OF TRANSMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
OFFICE OF THE SECRETARY,
Washington, December 6, 1911.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ended June 30, 1911, approved June 25, 1910, a report by Commercial Agent John M. Turner, of this department, containing the results of investigations of general trade conditions in Latin American countries.

Respectfully,

BEN. S. CABLE, *Acting Secretary.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

TRADE DEVELOPMENT IN LATIN AMERICA.

WEST INDIES.

BARBADOS.

The British island of Barbados is in area only 166 square miles, yet it has fully 200,000 inhabitants, or over 1,200 to the square mile, making the island one of the most densely populated places on earth.

Agriculture is the chief pursuit, and, without doubt, the island is the most intensely cultivated spot in the West Indies. Sugar is the chief crop, and has been from time immemorial; tobacco is grown slightly, fruit hardly at all, some of the neighboring islands finding it profitable to ship in fruits and vegetables.

The roads are excellent, made of coral limestone, from 20 to 30 feet wide, and kept in excellent condition for traffic. The vehicles in use for hauling the heavy traffic, such as sugar and molasses, are four-wheeled, bent-axle wagons, hung low, and usually drawn by three or four mules. The light hauling appears to be done by donkey carts, each one usually driven by its owner. There are many horses on the island, largely imported from the United States, but recently Argentina has sold some desirable animals.

Oxen are used largely on the estates, and are sometimes used as draft animals in hauling products to market during the busy season. Methods on the island are primitive.

GROWING OF SUGAR CANE.

There are very few agricultural implements in use. I saw very few—not over five plows during a 40-mile drive. Field work is all done by hand. Sugar lands are cleared by hand labor, and put in condition for the next crop with the spade and fork. Crops are rotated, either cotton or corn generally following the third year of sugar on a field, but sometimes potatoes (sweet) or yams are planted. The vegetable débris from the field of sugar is gathered, taken to the cattle sheds, and there allowed to rot with the animal manure, and is then taken out to the fields again.

The sugar cane is gathered, hauled to a windmill on the estate, and there ground or pressed, the juice being boiled into molasses, and thence into sugar if desired. The loss in this method is admitted by many men with whom I talked to be from 30 to 35 per cent; that is to say, that amount of juice is not extracted and goes to waste.

Suggestions that a central factory would be a decided advantage to the island were met in every case in the affirmative, but the lack of sufficient funds was always advanced as the reason why one or more such factories was not erected.

Manufacturers of central sugar machinery could do well if the financial problem can be overcome, and there is no good reason why it can not be. The black people are industrious, women work in the

fields and on the roads, and they must have a certain amount of thrift, because the building of the Panama Canal attracted many of the men there for employment, and it is common remark that these men are sending home to Barbados fully half a million dollars a year. There is a crowd of black people at the post-office about the 15th of the month collecting money orders from the Canal Zone, and it takes the clerks two to three days to pay them all off.

SUPPLIES FOR THE PEOPLE.

Laborers in Barbados earn 30 to 40 cents per day at farm work, the women getting half as much. They wear cotton clothing the year round, shoes a small part of the time only. The cloth for making the garments of the laboring classes comes largely from England; one reason given is that it has been coming from there, is good and cheap, and there is no reason for changing. The same reason is given why candles and lamps are in general use on the island, not even the largest city being lighted by electricity, gas being used, and there is not an electric-light plant on the island, unless it is some small private one.

Another reason why the fabrics used are English is because the American manufacturer or jobber will not sell to the dealer what he wants to buy, but insists upon him taking a full line. The incident was told me of a salesman from the States with a particularly desirable line of cotton cloths with some twenty-odd patterns in different colors and designs. The merchant picked out an assortment of what he thought he could sell, amounting to half the line, and the salesman would not take the order unless the full line was booked, as that was the way the goods were packed at the factory. He sold nothing, of course.

Salesmen come out regularly from England. All lines are represented. I met one man selling essential oils, and another with chocolate candies, still another with cheap prints, postal cards, and stationery, all from London houses.

Makers of agricultural implements could do well on the island, if the trade is large enough to go after, but there are over 3,500 estates on the island, and that makes that many buyers, and it is not as if the island was owned by large corporations.

All over the island large water-supply pipes have been laid along the highways with taps at frequent intervals for the people to draw water without cost. Any vehicle owner with a bucket on his wagon can water his animals every mile of his way to town and back, if he desires to do so.

There is little fuel on the island; wood is sold to the laborer at a cent a bundle, which would go in an ordinary water pail, unless he gathers the waste from the sugar fields, or buys charcoal, which is imported from the other island and British Guiana.

Cheap oil stoves could be sold in quantities.

IMPORTED FOODSTUFFS—TRANSPORTATION.

All the butter used is imported in tins, and some of it was apparently imported many years ago. Milk is used sparingly and is dear. Feed for animals other than native grasses is imported, oats and hay from the States, with Argentina starting to ship oats which are giving satisfaction. Flour is imported from the States, Canada, and Argentina. Some of it comes in barrels, and I learned that the reason was that a local cracker bakery bought all its flour in barrels in order to use the barrel to pack crackers for export to neighboring islands,

there being no packages or material to make them from on the island. Lard and provisions come from the States.

There is talk of erecting a cold-storage plant in Bridgetown, so that meats, vegetables, butter, and other supplies may be kept in good condition until used.

Facilities for getting about the island are excellent. There are many fine victorias for rent at reasonable rates, and even in Bridgetown, the principal city and capital of the island, these carriages are largely used in getting about, as the only other means, except walking, is to patronize a mule tramway that runs half-hourly cars and charges 8 cents for a 2-mile ride. The cars are small, cheap affairs, seat 20 to 24 people, and a person can spend a short half hour comfortably in going 2 miles on the single-track road, for one has a chance to visit with his neighbors on the switches.

There is a chance for some enterprising firm to electrify the tramway in Bridgetown and extend it. With reduced fares for distance riding the possibilities are excellent, but coal will have to be imported to produce the power, unless oil can be found on the island, and this seems hardly probable, as the island is entirely of coral formation and seems to be one large filter.

STEAMSHIP LINES AND HARBORS—TOURIST TRAFFIC.

The ocean traffic at Barbados is large. It is the island almost in the way of steamers going to and from South America and bound to New York or other northern ports. One can get a ship at Barbados for almost any European port by waiting for it. Passengers transfer from east and west lines to north and south lines and vice versa.

Some effort is being made to encourage tourist traffic to the island, and the climate is delightful enough to justify anyone requiring rest to visit it, but a few good hotels would contribute more to the comfort of the tourist than the climate. The present accommodations are not what one generally looks for at a tourist resort.

The harbor facilities are poor. Vessels with cargo have to anchor out from Bridgetown about a mile. Steamers discharge their passengers and their baggage into small rowboats. The bay is open to the ocean and is frequently very rough.

The island is well policed by black men in clean uniforms, and from the police force a very good band has been selected which plays for the public at stated places twice each week.

DOMINICAN REPUBLIC.

The population of the Dominican Republic is variously estimated to be between 400,000 and 500,000, scattered over an area quite as large as Vermont and New Hampshire, or about 30 to the square mile of territory. The total value of the exports of the country for 1909 was, in round figures, \$8,113,690, which shows a falling off, as compared with the previous year, of \$1,250,000, due largely to the low price and partial crop failure of cacao, the second largest article of export.

Conditions during the current year (1910) are more favorable, and when the figures are available it is expected they will show the largest exports in the history of the Republic. Sugar, the largest article of export, yielded in 1909 \$3,305,000; cacao, the second largest, \$2,759,000; tobacco, the third largest, yielded \$1,239,500; while coffee only returned \$128,000. The Republic imported from all countries during the year 1909 goods to the value of \$4,425,913, leaving a trade

balance in favor of the Republic of almost \$3,700,000. Of the exports the United States got 58 per cent of the whole and of the imports 54 per cent.

ARTICLES THE UNITED STATES CAN SUPPLY.

There are some articles of use in the Republic which the United States could supply and increase the percentage in its favor materially, and they are mentioned here to attract the attention of exporters. In 1909 the United States exported to Santo Domingo agricultural implements to the value of \$7,030, while Germany exported in the same period \$20,985, or three times as much.

Of cotton manufactures the United States sold in 1909 to the value of \$389,000, while Great Britain sold \$342,000. The United States got a little more than one-third of the trade in cotton goods, and it could easily get it all, as there is no prejudice against goods from the United States and our patterns are well liked. Dealers assured me they would as soon buy the one as the other.

Of earthenware the United States sold in 1909 \$1,767 worth, while Germany sold \$20,114, or nearly 15 times as much. All the trade can be had by the United States.

Of manufactured vegetable fibers, including jute sacks for sugar, cacao, and coffee, and ropes, Santo Domingo imported in 1909 to the value of \$128,776, of which the United States sold \$49,332, Great Britain \$34,277, and Germany \$39,343.

Of glass and glassware the United States sold \$16,300 and Germany \$11,666, and dealers told me the reason more of this class of goods is not bought from the United States was because the Germans packed their goods so much better that the breakage was very much less.

In hats and caps Italy is away ahead. The United States did a business in this line of \$1,470, while Italy sold \$27,966. The trade is worth going after, is not difficult to get, nor are the people hard to please.

In jewelry, watches, and clocks the United States sold \$7,970, while Italy shipped in \$28,000 worth.

Beer in bottles, the United States sold 5,300 dozen, worth \$8,155, while Germany sold 35,644 dozen, worth \$57,000. Dominicans seem to like the German beer, yet it comes packed in very expensive boxes, strapped and marked in splendid shape for export. It might be worth while for some of the brewers or exporters to go after a share of the trade. It is capable of development to a marked degree as the country prospers.

In paper the United States sold \$19,600 worth, while Germany sold \$25,890 worth.

If the United States would increase its exports in the articles mentioned, it could materially increase the percentage in its favor.

FLOUR FROM THE UNITED STATES.

Of flour the Republic imports practically all it gets from the United States, mostly from New York City. The imports last year were 52,000 sacks, valued at \$305,000. It was all shipped in 200-pound sacks, and up to January 1, 1910, paid a duty of \$5.81 per 100 kilos (220½ pounds). Since January 1 the duty has been \$4.50 per 100 kilos, or quite \$4 per sack. This trade can hardly be increased, as the cost of the flour landed and delivered to the baker

averages over \$12 per sack. One baker showed me his invoice for five sacks of a well-known Minneapolis mark which cost him \$12.75 per sack. The very poor and the people in the interior do not eat bread except at very rare intervals, it being too dear. Corn meal is raised on the island and supplies the place of wheat flour, while the enormous consumption of rice and beans largely supplies the demand for this class of food. Wheat flour is only eaten by the city residents, where the bakers also reside. Very little cooking is done by the natives.

ENCOURAGING OUTLOOK.

It is my opinion that the export business of Santo Domingo and Haiti can best be done from New York or New Orleans, or any port city of the United States having regular communication with the island. The purchasing power of Santo Domingo is increasing rapidly, as the people have become interested in developing their very rich country, the incentive to revolution being removed since the customs receipts have been administered by officials appointed from Washington.

The actual destination of the exports of the Republic may not be correctly stated in any official report, as shipments of sugar and cacao are frequently made to New York "for orders," and the final destination may be Europe; but for the purpose of arriving at the purchasing power of the people, it makes little difference where the exports finally land so long as the money comes back. With an increasing balance of trade in its favor, and with a reduction of its debt amounting to \$100,000 gold per month, it will not be long before immigration will be attracted to the island and its rapid development follow.

Investment is encouraged now; there are no laws regulating or restricting commercial travelers, who may come and go as often as they please. If samples of value are carried they may be entered at the custom-house, a bond being given by some local merchant, and the bond will be released if the same goods are taken out of the country in reasonable time. Merchants told me there had been a marked increase in the number of traveling men lately, and they were always welcome.

Catalogues and price lists should be in Spanish, although many of the importers are Germans. German capital is going in Santo Domingo quite freely. This year's sugar returns will be absorbed mostly by the Germans, not much of the money remaining in the country. Naturally, with the cash and commerce largely German, trade will drift into German channels.

MACHINERY AND RICE.

I came from Porto Rico to Santo Domingo on the steamer President of the Hamburg-American Line, and at the first port of the Republic at which it stopped there were discharged over 500 tons of rice, beer, and cotton goods from Germany, with some cheese from Holland, chocolate from Switzerland, perfume from France, and beer from Denmark. At the next Dominican port it discharged about 250 tons of sugar machinery from Scotland and a lot of rice from Germany.

Knowing that Germany grows no rice, I investigated the matter of such large importations from that source. The rice was in square

pockets of 100 pounds each, well sewed, and the sacks were heavy. It appears that the Hamburg-American Line proposed to start a line of boats to run from St. Thomas to Jamaica, stopping at half a dozen Dominican and Haitian ports. To support the line freight was necessary, and the new agents appointed by the company immediately began hunting up trade. A through rate on rice was made from Rangoon, Upper Burma, to Santo Domingo, via Hamburg. The ships of the same line carried the rice in the paddy from Rangoon to the free harbor of Hamburg, where it was milled, the feeding residuum remaining in Germany, where it was wanted, the balance of the rice being carefully assorted as to color, grade, etc., and sold to their West India friends, to be transported from Hamburg to St. Thomas, Danish West Indies, which is practically a free port, there loaded into the steamship *President* and delivered to the buyer.

EXTENT OF THE BUSINESS.

Let us see if this rice business amounts to anything, and if it is worth having. During 1909 the United States furnished rice to the value of \$9,261, while Germany furnished 18,000,000 pounds, worth \$391,546. The United States is a large producer of rice, is growing more than it can consume, and will soon need customers. The rice from Louisiana can not be shipped to Santo Domingo via New York, and drive out the German rice, as the freight would be prohibitive, but it is quite possible that the Atlantic, Gulf and West Indies Steamship Company might add the Dominican ports to their Porto Rico steamships sailing from New Orleans on regular schedule if freight would offer in sufficient quantity, and Galveston could be added if required. Lines are running that can be induced to carry the merchandise if exporters will get after the business. There is no prejudice to overcome; rice is rice to the man who eats it, and certainly we can compete in price.

ADMINISTRATION OF THE CUSTOMS.

While en route to Santo Domingo I heard some adverse criticism on the changes in duties, which had gone into effect January 1, 1910, and gathered that the reduction in duties had resulted in a great loss to the treasury receipts, while the cost of goods to the consumer had not been reduced at all. In this connection it might be well to remind those interested that prior to 1905 the Dominican Republic had administered its own finances and collected its customs dues. At that time the pressure from creditors became urgent, and the United States entered into treaty in March, 1905, to receive all customs receipts and divide them in the proportion of 45 per cent to the Republic and 55 per cent to the creditors, the indebtedness amounting to about \$20,000,000, which was funded. Practically all the revenue of the Republic is from duties on imports and exports, as property pays no taxes whatever, under the old Spanish laws, in effect since the existence of the Republic.

In the five years that the United States has administered the customs the debt had been reduced by quite \$7,000,000, and the Republic has had more money to spend for improvements, with half the receipts, than it had formerly enjoyed with all of them. The receiver of customs has handled the finances so satisfactorily to the Republic, and has become so familiar with the needs of the people, that last

July he submitted a new tariff schedule which called for a reduction of 15 per cent, and he made the prediction that after the commercial conditions adjusted themselves to the new tariff the yield under it would be entirely satisfactory, perhaps as great as that under the antiquated tariff with its cumbersome and excessive rates. Naturally a period of several months had to expire before shipments would arrive under the new tariff, as the Dominican Government withheld action on the measure until the last moment.

The general scheme of the tariff revision was to get away from the old Spanish idea of taxing prime necessities and letting in luxuries practically free. The revision made possible living rates for practically all articles of prime necessity—certainly great reductions over those of the past, and where increases were made they were based on values of those articles of greater worth and only used by people in the better station of life. It was this new tariff that was the subject of the criticism I heard, and wishing to get the facts I applied to the receiver of Dominican customs, Mr. W. E. Pulliam, Santo Domingo city.

Upon stating the case to him, Mr. Pulliam was very glad to give me the first official figures for publication, showing just how the new tariff was working, and he was firm in the belief that the new tariff would yield quite as much as the old as soon as business is adjusted to the new conditions. In explaining why the working of the new tariff had not reduced the price of goods to the consumer, Mr. Pulliam was careful to say that his obligations ended when the duties had been paid, and if the public was not getting reductions they should look elsewhere than to the collector. It is quite possible that dealers did not at once reduce prices to meet the tariff reductions, or that the saving was "absorbed" between the retailer and the importer, but the receiver felt it his duty to show the public how the tariff did reduce, so he published in the newspapers a daily exhibit on a certain article showing exactly what the reduction was in cents and in percentage.

WORKING OF THE NEW TARIFF.

Mr. Pulliam also consented to reply to inquiries concerning the working of the new tariff on matters pertaining to the import business, if stamped envelopes were inclosed for replies. The United States maintains a minister resident and consul-general in Santo Domingo city. American exporters or manufacturers desiring to increase their business may address either of the officials named.

The figures on customs collections for the first five months of 1909 and 1910 follow:

Month.	1909.	1910.	Increase (+) or decrease (-).
January.....	\$382,748	\$184,666	-\$198,082
February.....	221,813	209,772	- 12,041
March.....	250,412	261,629	+ 11,217
April.....	252,412	280,358	+ 27,941
May.....	269,636	308,304	+ 38,668

An annual collection of \$2,000,000 was stipulated in the convention precedent to any reduction of the tariff, and a monthly collection of \$250,000 is considered satisfactory, as it would yield \$1,000,000 a year more than stipulated, so it will be seen the receivership can be congratulated on the efficient work of the new tariff.

HAITI.

The total imports into Haiti from the United States in 1909 were \$3,831,965, an increase over the preceding year of \$515,000, while from all other countries Haiti imported only \$591,940. Of flour, the United States shipped 148,539 barrels, or practically all that was imported. The customs duty, which amounts to about 100 per cent. will, of course, restrict the growth of the business.

The flour business in the Greater Antilles stands about as follows: Cuba, with a population of two and one-half millions, imports 800,000 sacks, or one sack to every three of the population; Porto Rico, with a population of one million, imports a little over 300,000 sacks of 200 pounds each, or one barrel to every three of population; Santo Domingo, with about half a million population, imports 52,000 sacks, or about one sack to every ten inhabitants; and Haiti, with one and one-half millions population, imports about one sack to every ten of population.

Until financial conditions improve millers in the interior should seek business in the Dominican Republic and Haiti through their New York connections, because their troubles will be much less. The interior miller is at a decided disadvantage, owing to delays in transit, and where duties are so high, with fluctuations in the currency as decided as in Haiti, the exporter at the seaboard is the one who can do the trade with only ordinary commercial risk.

Haiti is not growing in commerce so rapidly as some of its neighbors, but the merchants are very friendly to the United States, which has the greater part of the trade in dry goods, implements, food-stuffs, and hardware. The wants of the people are not many and the country is fertile and productive where it is tilled, so that it is possibly a trifle more self-dependent than some other West India Islands. The national debt at the end of 1909 was \$25,430,330 gold and 9,976,256 gourdes, making practically \$27,000,000, the interest on which has been paid in advance for some time.

PORTO RICO.

The island of Porto Rico is about 100 miles long, 40 miles wide, contains about 3,800 square miles, and has a population of about 1,000,000. A railroad runs part way around the island, skirting the coast line, from San Juan to Ponce, via the ports of Arecibo, Aguadilla, and Mayaguez. Steamships visit all the ports mentioned to bring and take away cargo.

The island has about 1,000 kilometers (kilometer=0.62 mile) of first-class stone-built roads leading back from the ports, and it is proposed to extend them as rapidly as money is available. Their maintenance now costs the island about \$300,000 per annum, or quite \$300 per kilometer. This is regarded as high, and the cause of rapid deterioration has been closely studied by those in charge. Nearly all the traffic has been by two-wheeled carts of heavy construction, usually drawn by four oxen, two being yoked to the pole and two leading. The grades are quite heavy in places, requiring the four oxen to draw the loads up the hills.

The average load of these bull carts is 3 tons, the cart itself weighing about 1,500 pounds, so that the weight is in all cases over 7,000 pounds, and it is claimed that this weight carried on two

wheels is very destructive to the roads. In order to reduce this as much as possible, the use of four-wheeled wagons is being encouraged.

LEGISLATION AS TO TIRES.

A law was enacted, and approved March 10, 1910, providing that after November 1, 1910, vehicles of four wheels traveling over the public roads and carrying loads of 1,000 to 2,000 pounds shall have tires not less than 2 inches in width; 2,000 to 3,000 pounds, tires not less than 3 inches; and 4,000 pounds and up, tires not less than 4 inches.

Vehicles of two wheels carrying loads exceeding 1,200 pounds must have a tire $3\frac{1}{4}$ inches in width; provided that no vehicle of two wheels shall be allowed to carry a load exceeding 3,000 pounds; and, provided further, that no two-wheeled vehicle shall carry the load in such a way as to extend over 1 meter from its rear end; provided, however, that two-wheeled carts may be used always on any road for the hauling of native produce, lime, bricks, and all kinds of goods incidental to farming and industry.

As the ox cart has been in use on the island since the advent of the white man, legislation against it naturally excites some comment. In theory the ox cart offers the cheapest available method of transporting merchandise, but in practice it figures out differently. The carts are so built that, when properly placed on the cart, the load will balance and the oxen simply pull the load. It is claimed, however, that in going up the hills the load tips back, nearly lifting the pole team off its feet, and leaving the load to be drawn by the lead team, while in going down the hills the load pitches forward, throwing all the weight on the pole team, leaving no work for the lead team. In moving from one side of the road to the other it is said the ox carts cut into the roads much more than four-wheeled wagons would; hence the desired change.

MARKET FOR AUTOMOBILES.

The incident is cited of a large American manufacturer of automobiles, finding himself a little run down and needing rest, taking a steamer for Porto Rico, and upon landing arranging with a local liveryman for a coach to take him around the island. After he had gone a few miles and meeting a half dozen automobiles, he had his coachman turn back, paid him to be released from his contract, and arranged with a garage for a machine to take him on his journey. He said he had no idea there were such roads or such possibilities of trade, and while here he arranged an agency and actually disposed of half a dozen cars for shipment. In all there are close to 300 automobiles on the island, well divided among the different makes.

This island is hilly. The roads were originally built for military and heavy traffic, with little regard for easy grades. It is not unusual to find 10 per cent grades, and there is one very stiff climb up a 12 per cent grade. Some maker of automobiles could easily capture the trade of these West India Islands if a machine were made to fit existing conditions. There is no frost here, the heat is uniform, and at times in the sun a machine will run at a continuous temperature of 125° F. It may be that a larger radiating surface for this climate would be an improvement. The climate is hard on rubber, leather, and polished surfaces, so that if improvements can be made in any

or all of these, strides will be made toward capturing the trade. Varnish does not last. A fine-looking automobile will look like a second-hand one after 30 days' use. All exposed iron parts rust in a short time, brass tarnishes quickly, and nickel shows rust streaks after short service. Tops of leather are almost useless for automobiles, the rubber cloth ones do not last any time, and the only kind that seem to wear at all are those made of canvas, treated to make it waterproof. Some varnish or other polishing fluid should be used that would be more permanent. Leather molds quickly and needs constant cleaning. Other material that would not be attractive to moths, such as firm cotton drill, etc., could be used for covering.

The Porto Rican is a good spender; he is open to argument on machines, is not adverse to new things, and the trade is worth cultivating. Cars that will stand up under the work required will attract many buyers. Anything from a \$250 runabout to a \$5,000 6-cylinder can be sold in Porto Rico; agents with means can be found here, and buyers are open for demonstrations.

POSSIBILITIES OF SHOE TRADE.

At this writing (March, 1910) there are about 90,000 children attending the public schools of the island, nearly all wearing shoes, and those in the country districts who do not have them look forward to the time when they can. Many of the laborers do not wear shoes, very few of the ox-cart drivers wear them, but the time will soon arrive when all the inhabitants of the island will be wearing them, as the physicians claim that bare feet are the chief cause of anemic infection, and with the change in the organic law it is stated an effort will be made to have an enactment compelling all persons to wear foot covering. In the cities of the island very few people now go barefoot.

The class of shoes worn depends upon the class or position of the wearer. The wealthier citizens send to the United States or France for their fine footwear. It is possible to buy dancing slippers of the finest class here now, costing at retail, say, \$6 per pair. The best class of canvas shoes is not carried in stock. Upon inquiry among dealers I find the cause of not having a better-wearing canvas shoe is that local merchants have not been able to import them from the United States. It seems most of the manufacturers there look upon the canvas shoe as one of short wear, this opinion being based upon the short season in the United States, the fact that such shoes can be worn here the year round not receiving consideration. If good cotton canvas shoes with oak-tanned soles could be offered here there would be a ready sale. Leather shoes do not do well in the Tropics; the leather molds quickly, patent leather loses its gloss and becomes sticky, and taken all together cotton canvas shoes offer the greatest chances for extended sale. The uppers can be colored to match suits, but the largest sale will always be for white canvas with good leather soles.

Porto Ricans are not cheap buyers and do not want cheap things to wear. They want the best, and shoe dealers make a mistake in sending winter catalogues and cheap samples here. There are great possibilities for high-class shoes of all kinds, and satin shoes for ladies, slippers, and dancing pumps of the highest class can be sold liberally.

EXPORTS FROM THE UNITED STATES.

There was exported from the United States to Porto Rico in the calendar year 1909 a larger amount of leather and its manufactures than in any previous year. The comparative values were:

Articles.	1907	1908	1909
Sole leather	\$929	\$658	\$104
Upper leather:			
Patent or enameled	2,502	417	91
Splits, buff, grain, etc.	50,258	60,772	114,594
All other leather	39,410	1,783	2,302
Boots and shoes	644,351	467,109	716,715
Harness and saddles	45,667	42,850	47,849
All other manufactures of	70,910	69,706	79,017
Total	854,017	643,295	960,672

JAMAICA.

The island of Jamaica has quite 800,000 people, one-half of whom are quite poor, and 100,000 of whom live on an average income of about 12 cents per day. The government does what it can to employ the poor, as all the stone for the repair and building of roads is gotten out by hand labor and broken ready for use at 24 cents per cubic yard, and I have been told that it takes a woman 2 days to earn this sum.

The island exported in 1909 goods to the value of a trifle over \$10,000,000, of which the United States bought about \$6,300,000 worth, or, say, 60 per cent, while in the same year the island imported merchandise to the value of about \$11,800,000, and of this amount the United States sold Jamaica about \$5,700,000 worth, or about 47½ per cent. The average percentage of sales by the United States for a period of 5 years is 38 per cent, so last year shows a good gain in trade.

Almost all the American imports from Jamaica are bananas, of which over 13,000,000 bunches were shipped in 1909. With this article Jamaica is almost a one-crop island. It was not always so. In 1887, the year of Jamaica's meridian of prosperity, the island exported 46,000 short tons of sugar, and immense quantities of rum. There is a large area available for sugar cultivation now, and attention has been awakened to the possibilities of that business. The land is very rich. I was told by a man interested in the business that he could show many thousand acres of land which had been producing sugar each successive year for over 40 years without replanting.

LANDS NOT FULLY UTILIZED.

In fact, the resources of Jamaica are remarkable, as shown by the following facts: Of the available land on the island, 242,000 acres are tilled lands, 590,000 are used for growing grass and for pasture, and over 1,270,000 acres are woodland. Of the 242,000 acres of cultivated land, in round numbers 28,000 are in cane, 26,000 in coffee, 10,000 in cocoanuts, 57,300 in bananas, 110,000 in vegetables and root crops, 7,000 acres in cacao, and about 2,500 acres in minor products. The \$10,000,000 worth of exports derived from this cultivation is more than half fruit, while nearly \$1,000,000 represents Jamaica rum, distilled from molasses.

There are thus about 1,800,000 acres of land available for cultivation in sugar or almost anything else one wants to plant, as crops

grow well. There might be danger of a dry season, for which the usual provision can be easily made. The country having nearly natural reservoirs, only dams are needed.

The large proportion of unworked land on the island might give the impression that agriculture is stagnant, but the figures of exports and imports for periods of 10 years for 50 years show a gradual increase, with last year at the top. The cultivation of sugar has declined from 47,000 acres in 1869 to 28,000 acres in 1909, caused by the abolition of slavery and abandonment of plantations. For instance, from 1839 to 1896 there were 518 estates abandoned, and from 1896 to 1909 there were 64 abandoned.

This shows clearly that nonresident landlordism does not pay where negro labor is employed, or so many estates would not have been abandoned. At present the situation of land ownership must be very encouraging, the peasantry largely owning the holdings they cultivate, as the number of properties worth \$100 to \$200 is 110,694, while the number of properties worth over \$200 is 22,320. The negro has gradually acquired land, but he evidently needs help to work it.

RETAILING AND BANKING—SUBSIDY EXPERIMENT.

The imports of the island are distributed through 35 importers, 71 shopkeepers, and 4,800 retailers, or really a little over seven centers of distribution to every thousand of inhabitants. Many of these shopkeepers are Chinese, and wholesalers tell me they are desirable citizens and good merchants in every way, paying promptly and extending as liberal credit as conditions warrant. This small number of distributing mediums can not indicate that the people have gone into merchandising, for the percentage is small. The island has vast undeveloped resources, is near a market that will take all it can produce, but it lacks capital to exploit the fields. The government is stable, the climate is delightful, there are good railroad facilities capable of extension, with feeders tapping fertile districts, and the island has about 2,000 miles of good roads.

Banking facilities are ample for the wants of the people; money can be had for commercial purposes at 6 per cent, and good "two-name" paper can get it, as Canadian bankers are in the field. Money deposited with the banks draws 3 per cent. This cheap money for industrial or agricultural purposes is not to be had at many other West India islands, as in Porto Rico the interest rate is 9 per cent, in the Dominican Republic 15 to 18 per cent, in Haiti not below 15 per cent, and in Cuba 8 to 12 per cent.

The Jamaican government has done much to help the export trade, and thus stimulate agriculture, but from reports it would seem that one expensive experiment had not been successful. It appears that the island and the British home authorities agreed to a subsidy of \$200,000 per year to encourage the export of bananas to the United Kingdom. In 1908-9 there were exported thither only 954,000 bunches of bananas, of which 780,000 were carried under the subsidy contract. During the same period there were exported to the United States 13,635,000 bunches.

TOBACCO AND SUGAR—FOREIGN CAPITAL.

Jamaica raises several kinds of tobacco, some suitable for filler and wrappers of cigars, and this class of tobacco appears to suffer for

lack of a market. If it is as good as Cuban tobacco, no one knows it, and England levies on it the same import duties as on other tobaccos. There is also a class of tobacco grown called "Jackass rope," which is largely used by the natives. In 1909 Jamaica exported about \$145,000 worth of tobacco. It appears that there was too much rain for the tobacco last year. Two new sugar centrals are in contemplation in the vicinity of Montego Bay, which may lead to increased acreage in cane. Jamaica apparently suffers from lack of enterprise and capital. If these were supplied the country could well do a combined annual business five times that now done. Unless these necessary elements are supplied the United States evidently has all the business on the island worth going after. To get much more would necessitate competing with long credits now given by English and German houses, and long credits are not desirable where local money can be borrowed at the banks for 6 per cent, as in Jamaica. Foreign capital seeking investment in agricultural enterprises might do well in Jamaica, where labor is cheap, though inefficient. If something is done to increase the purchasing power of half a million negroes, Jamaica will become a larger importer of foreign goods.

VEHICULAR TRAFFIC IN JAMAICA.

In the country districts of Jamaica one meets few vehicles, when the area and population are considered. Almost all the heavy hauling is in two-wheeled carts, drawn by two or three mules. The main roads are maintained by the insular government, the others, which act as feeders, by the counties or parishes. Generally good and fair loads can be hauled, but on all roads crushed stone has been placed where needed, allowing the traffic to level it down. The traffic is therefore regulated by the condition of the roads.

The carriage traffic is comparatively heavy. On the city streets carriages are met everywhere and the cost of using them is reasonable. A ride in the city limits of Kingston costs but sixpence (12 cents), the rate by the hour being equally reasonable. The tram fare in Kingston is 4 cents, with seven tickets for 24 cents. Both carriages and trams do a good business. To go a distance in the country not reached by the railroad a carriage or an automobile is necessary, as the heat and glaring sun prohibit much walking. A garage proprietor gave as his reasons for the comparatively high charges for automobile service that he had to pay a duty of 16½ per cent on all automobiles and parts, and up to that time 34 cents per gallon for gasoline, figuring also 12 cents per mile for tires. For a trip of over 200 miles in 2 days he charged on a mileage basis of 25 cents per mile.

The generally good roads would be excellent if the stone were rolled when applied. With the present system there is no inducement for importing fine vehicles with rubber tires or automobiles. Steel tires can stand the broken stone. It is said to now cost about \$80 per mile to maintain the roads, which is not high. An engineer who claimed to know told me that by using as fuel local wood, plenty of which is available, road rollers could be maintained in Jamaica at a cost of about \$10 per mile.

The stone is quarried near the roads and brought to the roadside, where it is broken with hammers into small pieces, mostly by women and girls, for one shilling (24 cents) per cubic yard. A road fore-

man stated that they averaged about 12 cents per day. In the writer's trip of 250 miles over 500 stonebreakers were seen. It took 9 hours of running time to make 120 miles in a pretty good motor car. In Jamaica it is cheaper to rent automobiles than to own them, and tourists can save money by leaving their cars at home.

The taxes on vehicles are heavy, amounting to \$5 a year per wheel. Thus, a four-wheeled vehicle pays \$20, donkey carts paying only half that sum.

FLOUR AND CORN MEAL.

The 800,000 people of Jamaica imported and consumed in 1909 223,260 barrels of flour and 47,000 sacks of corn meal. This is nearly one sack of flour or meal to every three of the population, and is quite as good a proportion as in any of the West India islands.

The value landed in Jamaica of the flour imported was, in round figures, \$1,205,000, or about \$5.50 per barrel. Deducting the freight and other charges the price averaged a little less than \$5 f. o. b. New York City.

Nearly all flour imported to the island is blended, and it nearly all comes from New York City. In my opinion shippers in that city are far better able to do the business than the interior millers. The sailings are frequent; flour is often ordered by cable to catch certain boats, or importers here notify their shippers in New York to have so many barrels of flour come on each steamer of a certain line. Furthermore, importers send their orders to New York to be filled at certain prices, and the shipper must shop among the receivers of flour to find what will suit at the price he can pay.

Spring wheat patents are not wanted by the average baker, as they are not white enough, and are too dear. The fact that gluten will absorb more water and give more pounds is apparently not considered by the importers and bakers whom I met.

The sack required is the heavy Osnaburg, containing 196 pounds net, although some few barrels are imported; sacks are preferred. The price of a flour is the point first considered. Mills located in New York or close to that city enjoy a large portion of the trade, although Canadian mills furnish a fair portion of the blended flour. One mill in Ontario is quite a favorite, shipping an excellent flour. The flours I examined showed a blend of about 75 per cent white well-dressed winter clear to 25 per cent of a spring wheat straight. The baker said this percentage gave a very quick, active flour, suitable for both bread and biscuits, as well as cakes.

Winter wheat straights and clears will sell here to good advantage, and mills having a surplus of flours that will grade No. 2 extra in New York might do well to seek a portion of the trade through their New York agents, although several of the large importers here maintain New York offices. The trade in flour is increasing. This is shown by the figures for the past five years given below. From what I have gathered of present economic conditions and the changes in contemplation, it appears reasonable to expect this island soon to consume more flour in proportion to its inhabitants than any other West India island. A year of low values will do much to advance the trade and increase consumption.

The imports of flour in 1905 were 170,375 barrels; in 1906, 160,604; in 1907, 175,696; in 1908, 248,435; and in 1909, 223,260 barrels. The

increase of over 50,000 barrels in 1908 was due to the necessity of replacing much that was destroyed by the earthquake in 1907. The importation of corn meal in 1908 also assumed abnormal proportions, reaching quite 60,000 barrels.

Jamaica is doing very well, when the great loss suffered such a short time ago is considered. While marked improvement is noted in the appearance of Kingston, there are still many piles of ruins which record the financial ruin of the owner. The losers by the earthquake and fire in January, 1907, received their insurance only a short time ago, after a hard fight to demonstrate that the fire started first. This insurance money is being rapidly spent in new buildings, and the business part of the city is vastly improved. The rural part of the island is doing well and increasing its output.

TRADE COMPARISONS.

While the United States supplies almost 50 per cent of the imports of Jamaica, it may be of interest to know the important branches of trade in which other countries get the larger part, the following statistics being for 1909:

In felt hats the United Kingdom supplied \$25,000, the United States only \$500 worth. In straw hats \$50,000 worth came from England, and only \$1,000 worth from the United States.

The United States supplied \$4,000 worth of earthenware and china, the United Kingdom \$30,000, and Germany \$6,000.

Great Britain sold \$20,000 worth of artificial fertilizers to the United States, \$5,000 worth.

In saddlery and harness the United Kingdom sold \$40,000, the United States only \$8,000 worth.

The United States supplied \$7,500 worth of soaps to Great Britain's \$130,000 worth.

In umbrellas the United States sold \$100 worth, the United Kingdom \$5,000 worth.

In machinery and parts thereof, including steam engines, the United Kingdom sold \$160,000 worth to \$10,000 worth supplied by the States. In implements, including agricultural, Great Britain sold \$35,000 worth to the United States, \$9,000. In hardware and cutlery, the United Kingdom sold \$165,000 worth, the United States \$80,000.

Practically all woolen goods came from the United Kingdom.

In cotton goods, the United Kingdom supplied \$40,000 worth of hosiery to \$5,000 from the United States, and in piece goods, the British sales were \$1,100,000 against \$450,000 American.

In foodstuffs the United Kingdom supplied \$140,000 worth of rice to \$75,000 supplied by the United States. The British and American sales of condensed milk were equal—\$25,000 each—while Germany supplied \$125,000 worth. In pickles, vinegar, sauces, condiments, and confectionery, the United Kingdom led with \$75,000, while the United States only supplied \$15,000 worth. In fish Canada led with \$400,000 worth of dry fish against \$150,000 worth from the United States, while in pickled fish Canada is credited with \$160,000 against \$1,000 from the United States, and in alewives Canada supplied \$150,000 worth against \$29,000 by the United States.

In beer and ale the United Kingdom supplied \$150,000 worth, the United States only \$29,000 worth.

TRINIDAD.

One is at once impressed with the bustle and activity of Port of Spain. It is a busy place, the shops are filled with buyers, and the streets are full of traffic. The electric street cars are well patronized, the rate of fare being reasonable—7 tickets for 24 cents.

The streets are mostly asphalted, consequently noiseless and dustless, and the glare, always noticed when coral rocks are used for paving, is not present. Many fine homes, or bungalows, have been erected in the coves and beautiful bays around the island, and these offer a fine field for gasoline launches, many of which are now in use, though many more can be sold.

The island has excellent roads, offering every inducement for the automobile, and, better still for the makers of those machines, there is a wealthy buying public.

Trinidad enjoys a large revenue from its pitch lake, considerably over \$200,000 per year being paid to the island as royalty. The wonderful part of the resource is that the pitch lake seems to fill itself up, the present level being only a few feet below the original level. As a train load is taken out of a hole, work is commenced at another point, and the hole fills up from below in a short time. One can drive over the lake in a carriage. The lake is quite hard on top, and I was told that asphalt in a liquid state is 40 feet below.

This revenue from pitch helps to reduce taxation. The customs duty is much less on all classes of merchandise than in any other of the British islands, but owing to contemplated improvements the rate on many articles has been increased 5 to 10 per cent.

LARGE GAIN IN FLOUR IMPORTS.

The duty on flour is 80 cents per barrel, and in 1909 there were imported 231,000 barrels, all coming in osnaburg sacks of 196 pounds, except some very small shipments for special trade shipped in wood. In 1905 the imports of flour were 165,000 barrels, the increase being gradual each year up to the present highest level on record.

The bread in Trinidad is good. Many Mohammedans from India are working in the cane fields and on the estates, and these are all bread eaters. A baker told me the coolie housekeeper buys her bread first, then makes the remaining money supply the balance of the domestic necessities.

There is plenty of work for laborers at 36 cents per day for the men and 24 cents for the women, and these wages are higher than in any of the other islands. The population of Trinidad is about 300,000, so the consumption of flour on the island is nearly four-fifths of a barrel to the inhabitant, or higher than on any other of the West India Islands, and there is every evidence of the trade increasing to quite one barrel per inhabitant. This will be the same basis the United States was on twenty years ago, then regarded as a very large per capita consumption.

PROSPECTS AND COLLECTIONS GOOD.

There appears to be plenty of work for laborers. Cacao, which is an important crop, is being pushed, and more care is given to the extension of the outlet each year. Sugar has been profitable; merchants have been able to get in their collections with reasonable

promptness, and money at the banks is cheap, being 6 per cent for good two-name paper, which is very low on an agricultural island. There are two banks on the island, both branches of large Canadian concerns, but they seem able to do all the business and accommodate the borrowers.

A frequent topic of conversation in Trinidad is oil. Drilling for petroleum is an extensive business. Notwithstanding large storage tanks, and natural lake basins, many thousands of gallons of crude oil have run into the sea owing to lack of storage space. I was told that two kinds of oil had been struck, one with asphalt base, the other with paraffin base, and it was the intention of the British Government to burn the former kind in its war ships. Oil has been struck in paying quantities, and the field is being explored. Coal, said to be of excellent quality, has also been found. The fuel field is said to be between 700 and 800 square miles, and may lead under the Gulf of Paria.

HARBOR IMPROVEMENTS.

Port of Spain, the leading city of Trinidad, has a well-protected harbor, but because it is opposite the delta of the Orinoco River of Venezuela, and also has a large local river emptying into it, the harbor has gradually become filled with mud. Boats of 20 feet draft and over frequently have to anchor out 2 miles from the docks or city, and if they have a greater depth must lie farther out to get swinging room on the changing tides. This makes a great expense for barging all merchandise, as there is not over 5 feet of water at the docks. British steamers frequently coal at Port of Spain, and the coal is brought alongside in barges, lighters, and schooners, and transferred by hand by native negro labor. This is slow and expensive and not a modern method. If English war ships are to come there for oil, and possibly coal, other methods will no doubt be advocated, and possibly adopted at an early date.

A gentleman largely engaged in commerce on the island informed me that the governor of Trinidad proposed to lay before the authorities some plans for improvement. He did not know the plans, but stated that he and others had discussed something along the following lines: A long pier, from 4,000 to 5,000 feet long, to be built on cement piles sufficiently strong to hold a warehouse in the center and rails for freight trucks on each side, running to the end of the pier. Certain parts of it would be without the warehouse in order to allow for switching room for loaded and empty trucks. The pier to be not less than 100 feet wide. Swung under the pier was to be a series of pipe lines for supplying vessels with oil while discharging cargo, thus saving the expense of going to another port on the island. It was proposed that the pier should be neutral property so far as customs were concerned, or practically a free port, so that vessels coming through the Panama Canal, when it is completed, could come to Trinidad for coal or oil, discharge part of their cargo, take on some which had been left to meet them, and proceed on their journey with the least possible loss of time.

The plan contemplated making the improvements for \$5,000,000, to be raised on long-time bonds.

The reason for building the pier, instead of dredging the harbor as stated, was that the level of the bottom of the bay had remained the same for a period of forty years, and apparently the silt had not

deposited anything on top of the old harbor bottom, although it might be gradually extending its area and reducing the depth farther out to sea, and as the deposit was mostly mud, the expense of dredging would be very heavy and continuing. On the other hand, the pier would overcome all difficulties, and provide for free transfer of merchandise without affecting the customs regulations, as goods would only encounter the duty on being taken from the pier into the city.

If this scheme has anything in it, all the iron, cement, lumber, piping, and other supplies will likely come from the United States, and American business men will no doubt maintain an interest.

EXTENSION OF CREDIT.

In talking with merchants in the various islands of the West Indies one hears much of the matter of credit. The United States exporters and manufacturers are criticised, at times severely, for insisting upon cash or quick payment of invoices.

The exporters of Europe are held up as examples in the line of credit givers, Germany and Great Britain particularly being liberal in this matter, bills being drawn at three and four months, and not infrequently at six months' time, and Canadian shippers of flour and staples are also credited with being liberal in credits. Merchants not infrequently give as a reason for not doing more business with United States exporters, that they could get so much longer time from European sellers, even if the goods cost a trifle more, that they sent their business where it was appreciated and the courtesy of credit extended.

After a careful survey of the situation on many of the islands it seems to the writer that the United States exporter and manufacturer are in the right and that short credit should be the basis of doing this business. I have explained in every case where the matter has been brought up that American manufacturers are compelled to pay cash for raw material, for labor, and in many cases to prepay the freight on shipments to these islands, and that they should not be compelled to add the cost of the risk, as there certainly is a calculable risk when credit is extended, and it must be included in the price of the goods which the merchant pays when bought on time, no matter where the goods were purchased. This has been denied by those buying in England, who say that the price is the same whether one buys large or small lots, and the time is extended with the price. Invoices were shown me to prove this statement, and it seemed to be true. Yet, if it is true, as was explained to the merchant, why did not the invoicing exporter express his rate of discounts for quicker payment? There was no discount, the terms were what were called "regular," and if any longer time was required it would make a small supplemental charge to offset the interest.

The general high quality of American goods was admitted, and the comparison of prices showed a little in favor of the American exporter; but in the matter of terms he was at a disadvantage, and with certain merchants this seemed to be so important that it threw the trade from America to Europe.

AMPLE BANKING RESOURCES.

After discussions with merchants the matter of credits was taken up with the local bankers, and after finishing the field it is my belief

that the American is correct and that the present policy of short credits should be continued and encouraged as much as possible.

The United States has done very well to get the business it possesses in these islands. It has no large investment of capital in their industries, with the exception of Cuba and Porto Rico. American capital is largely used at home, and European capital has built and enlarged the cities, built and equipped their improvements, and Canadian capital furnishes the money for the majority of the banks, as the large Canadian banks have many branches all over the islands. The island is very small and unimportant that does not have its branch bank.

From a house-to-house canvass it is evident that the best stores in every town are where American goods will be found in the most liberal assortment, and in many of the stores of the second class a fair line is carried. These goods represent an investment of cash, and are not relegated to the back of the store and hidden behind piles of boxes. They are kept to the front and sold, so as to get the money out of them.

All the Canadian bankers visited expressed a willingness to take all the good "two-name" paper they could get and discount it at 6 per cent. They agreed that many importers were selling on time to small storekeepers in the interior of the islands, but when asked if those small storekeepers would give an acceptance at, say, sixty days for their purchases of the importer, and the importer should indorse and present that paper for discount, if it would be accepted, the bankers said it would be satisfactory.

The logic of extending long time to a merchant who can get such banking accommodation is not sound. Much good business may be secured and the American exporter is losing trade by not seeking it zealously, but to my mind it is quite as necessary to get the cash for what is sold as it is to sell it, and if salesmen come into this field and urge longer time than just enough to allow the goods to arrive and pass inspection, my opinion would be that they are not canvassing the right class of merchants.

Long credit in the West Indies means furnishing the capital to carry the stock of the importer or for him to trust out. It leads to careless methods, slack supervision, and eventual loss. Good merchants do not want long credit, and others do not seem entitled to it.

SHORT-PAID POSTAGE.

Many importers of goods from the United States complain as to the carelessness of American merchants and others doing an export business in not sufficiently prepaying their letters and thus imposing a penalty on their customers, amounting in some countries to double the unpaid postage.

This is a small matter, but it should not be. It can be easily explained that the man who wrote the short-paid letter did not mail it, and the fault is with the office boy, who forgot to put on the extra stamp. It can be argued that one case amounts to only a few cents, and it is too small a matter to talk about. One merchant assured me that recently in one American mail he had to pay 60 cents penalty, and that only one letter in that mail had been properly stamped.

Almost every person knows the course of a letter from the man who writes it, to the post office. The stenographer, it occurs to me, should be the one to write the letter on export colored paper, or direct and stamp the envelope at the time of writing the letter requiring double postage. The office boy who copies or mails the foreign letter is generally the most poorly paid and least efficient of those through whose hands the letter passes. Why not make the rule in every office to whose notice this may come that the stenographer is to address and stamp the envelope for every foreign letter? Frequently printed envelopes issued by the United States Post Office Department are used, and in that case additional stamps can be affixed by the stenographer.

It amounts to more than one thinks to neglect these small matters. When an importer in a foreign country receives a letter from the United States which is short paid, and the letter says, "Inclosed please find a sample of our latest pattern of so-and-so," and the sample is not inclosed, that importer is angry, and the exporter might as well not have written the letter. When the letter is in reply to some complaint, and the writer goes on to say that the fault can not be his, as his force exercises the greatest care in filling orders, every item has a double check before it gets out of the shop, etc., and when this letter, too, is short paid, it has the effect of weakening the defense. Such carelessness reflects on the house, and not on the office boy.

SOUTH AMERICA.

BRAZIL.

TRADE REPRESENTATION.

A mistake made by shippers from the United States is that their goods have been shipped to foreign concerns here. To talk with such importing firms in Brazil on the subject of American goods and American methods might make the average American ashamed of his country. The code of American commercial ethics is supposed to be away below any other standard. However, much of this talk will not stand investigation. Many of the cases cited have an entirely different side to them, if the shipper could have a voice. Nevertheless, this criticism continues and does harm. Every importer of goods is influenced by the common cry, so that until they become known American travelers or principals are looked upon with suspicion.

If American goods had originally been introduced through American houses, or by resident American agents, it is admitted that we would have much more business in Brazil. Sales would have repeated oftener, a continuity of business would have resulted, and American manufacturers would not say: "We formerly did quite a business in Brazil, but somehow it got away from us and now we do nothing, and will have to commence all over again." For this reason American manufacturers should come down and look the field over and talk with the various houses handling American goods.

American goods stand high. The class of goods shipped is good, and repeat orders should be going forward, but the method of introduction is wrong, and an inspection of the field makes even the present volume of business surprising. This has been secured by quality.

COOPERATIVE AGENCIES ADVISED.

To start a house in Rio would be costly. Rent, labor, and other items would reach to \$25,000 per year, and this is probably beyond the average manufacturer's ability; but why should not half a dozen combine on the expense? Many manufacturers could stand \$5,000 per year to try the Brazilian market, and, if a few could get together, that sum from each would accomplish the desired result nicely.

The large importing houses here do not confine themselves to one line. They handle a dozen. They are steamship agents, insurance brokers, and exporters of coffee and other products. The American goods they handle are an incident, and methods differ but little from the New York exporter's method. When goods are asked for they quote on them, and the only difference between them and the New Yorker is that they have a sample on the spot.

Half a dozen American houses established here, each handling several different lines, would make such an inroad into Brazilian business that they would continue of their own momentum. Serious men should be sent to take charge, men who know banking and exchange and are familiar with the shipping business, so they can see a cut in freight rates before a shipment starts.

Credit should be extended to houses entitled to it. Goods carried in stock can always be sold, as styles change, because the interior opens up a large field for cheaper goods. With the high Brazilian tariff, the best goods are cheapest, and this point should be pressed. I can not see that the foreign merchant has gained any headway in sending cheap goods to South American countries. Everyone who handles the goods knows they are cheap.

American-made engines are lighter than European, because we have better iron, and it is not necessary to use so much to accomplish the same work. Put an American-made engine in a shop beside a European engine, with a European salesman to do the talking, and he will make weight of material in the European machine count for more than any half dozen points in the American engine. The same thing will apply to other goods. Agricultural implements should be handled in foreign markets by Americans if they are of American make, because the American generally knows more than any competitor about the average implement.

GERMAN SELLING METHODS.

In Brazil the method of selling pursued by the salesman from Germany is in general as follows: All prices are free on board cars at the factory in Germany. Having completed his sales, the selling agent adds to the invoice the freight to destination, charges a commission on the freight as well as on the merchandise, and sends the invoice, the bill of lading, and the insurance papers direct to the consignee in Brazil, and draws a bill payable at 90 days' sight on the buyer.

This bill is discounted by the seller at his bank in Germany, eight months' interest being paid for the discount. The documents are not attached, but are sent direct, and the bill of exchange comes alone. Upon presentation it is accepted, and upon maturity it is paid by a 90-day banker's bill on Germany; that is to say, the merchant pays his acceptance by buying of his banker a bill payable in Germany at another banker's there 90 days after sight. Of course he buys that bill at a lower rate of exchange than he could buy a sight bill for the same amount.

The eight months' interest paid by the merchant in Germany is arrived at as follows: Ninety days' sight, one month to get the bill to the buyer, one month to get it back to Germany, and three months for the maturity of the banker's bill.

This method of financing seems to indicate that the German banking facilities are superior to those in the States. The German banker in making the discount accepts single-name paper, without documents. Very few American houses could float a large line of such paper, and the line would have to be large if the exporter did much business, as before the maturity of the paper other transactions would be made in due course of business, and the importer in Brazil would be sending additional orders.

DISADVANTAGE TO AMERICANS.

The drafts in question are drawn in marks and sent to a German bank to be paid. The American shipper could draw in dollars, but he could not send the bill to an American bank to await maturity, as there is no American bank doing business here. European exchange is current. The transaction runs for eight months before completion, and American bankers usually do not want such long-

time paper. They prefer four months' bills to be paid by sight bills at maturity.

The German banker regards such paper as good security, while the American banker's judgment might be questioned for discounting time bills without documents. If the documents could accompany the draft, it is possible the American merchant could make the transaction, as upon surrender of documents on acceptance the banker has two-name paper as security instead of one-name with documents. The European rule prevails here. He who accepts pays or fails. No claims, subterfuges, or extensions are granted.

The 90-day bill sent to Germany in payment of the original bill is quite as good, or better than, cash, because the banker can rediscount the bill in case of necessity and receive the credit at a central bank, while the American banker would find difficulty in rediscounting the bill in case of stringency or panic. It would be clearing-house security only.

WHAT COULD BE DONE.

Considering the matter carefully, I should recommend to the exporter in the United States the sale of merchandise at three months, acceptance to accompany documents, to be surrendered on payment only, less the usual banker's rate for short-time paper; that is, if the goods arrived at destination before the maturity of the 90-day bill, the importer would have to pay the bill to get the documents, and would be entitled to the interest at the current rate for the unexpired term of the bill. It is admitted the German facilities are better for the exporter in Germany.

Interest rates for discount in north Brazil run from 10 to 12 per cent. The banks are either English or German, and there is abundant capital. When the paper offered for discount is unexceptional, the rate is lower. If the risk were reduced to a minimum, the money could be had at about 5 per cent, or certainly not over 6.

It seems good business to come into this field and do business on a cash basis, or as near that as possible, making prices so attractive that the merchant and importer will see it to his advantage to buy.

COST OF TRAVEL.

American merchants and manufacturers sending their salesmen to Brazil will be surprised at the expense accounts of their men, as they will doubtless be higher than any they have before seen.

There is no way of reducing the expense if a man insists upon his work being well done. In Pernambuco I asked a salesman to allow me to see him get to work and open his samples. He had druggists' sundries from the United States, in three trunks, weighing not over 500 pounds for the three. Pernambuco is a city of about 150,000 inhabitants, has a large territory producing sugar and cotton tributary to it, and the items will apply to any other place along the coast. They will vary a little, but ordinarily any salesman will have them to meet.

It cost 25 milreis (\$9) to bring the trunks from the steamer to the shore and 5 milreis (\$1.80) to haul them to an empty room for exhibit. This storeroom was up one flight of stairs, over a shop. The salesman hired a man for 1 milreis (36 cents) to sweep down the stairs and make them presentable. He had to buy six boards at 1 milreis each for his benches on which to spread his goods. He employed a car-

pentner to make him four simple horses on which to lay his tables. The cost of the lumber and horses was 10 milreis. A man charged 1 milreis for carrying the outfit to the hired room. The salesman then bought 1 milreis worth of wrapping paper to cover his benches and proceeded to unpack his wares for inspection. He had to pay a month's rent of the room, although he expected to be there only two weeks, and he felt himself in luck to find a room so near the business center. The rent was 50 milreis for the month. It cost that salesman \$33 before he had shown his goods to a person.

There is no other way. Hotels do not have sample rooms, and if they did they are so located that buyers could hardly be induced to visit them on account of lost time. Another salesman from Europe told me it always cost him twice what I had enumerated to get started because he had eight trunks of European goods and he required a larger room.

PORT CONDITIONS AT PERNAMBUCO.

The steamships do not land their passengers, who must get ashore the best way they can. Each passenger is compelled to hire a row-boat, usually after considerable dicker. The boatman lowers the baggage over the ship's side into his boat. The passenger descends a long flight of stairs and upon reaching the bottom takes his chances when the stairway and small boat meet and steps aboard. The journey to land is accomplished and the baggage deposited on shore, when the boatman's fees are payable. The dicker with the land man to haul the luggage to destination then begins. This, when arranged, ends in having the lot deposited in a room, always at a cost entirely out of proportion to the value of the service.

There is no chance for a salesman to reduce his expenses. He has to go through exactly the same motions every time. He can not sell his lumber for a quarter of what it cost without spending more time than it is worth. The carpenter does not buy his lumber of salesmen, and says so.

HIGH COST OF EMBARKATION.

I left Pernambuco by a Royal Mail steamship from Southampton, paying \$59 for a four-day trip, and at the time of purchase asked the agent if the price included taking myself and baggage to the ship. He promptly replied that it did not. He explained that his line had attempted to take passengers and their luggage to and from their ships, but that his life had been threatened four times by the boatmen of the harbor, and the authorities had asked him not to disturb the method of years and take the living of the boatmen away, as, if all steamships did the same, there would be nothing for the boatmen to do.

The boat on which I sailed was large and could not come inside the breakwater, so the small boat ride was taken in a heavy ground swell that nearly swamped it. In rough weather or in the rain there is no help for the passenger, as it is the small boat or nothing. Bad weather almost always augments the price.

The cost of getting one's self and baggage on board the steamer frequently amounts to one-quarter of the passage money. Vessels do not come alongside docks, but anchor in deep water, with sufficient room to swing with the tide. If a harbor happens to have a number of ships in it, the last comer takes a position quite remote from the shore. Where baggage is landed in the customhouse, there is generally a delay of one or two days.

TRADE POSSIBILITIES IN NORTHERN BRAZIL.

A casual investigation in Para will convince any business man that the manufacturers and exporters in the United States are missing great trade opportunities here.

The whole Amazon River country has to buy every article used by the people working or living in the section, and the region comprises many thousands of miles of navigable water. Para is the great distributing point, although much of the material for upriver points is ordered for direct shipment from point of embarkation to destination, large steamers running direct from Liverpool, New York, and other points several thousand miles up the Amazon and its tributaries.

Every imaginable article of commerce is required. The cost at destination cuts very little figure so long as the article is what is wanted and gets there within reasonable time. Many of the upriver firms maintain offices in Para, and business can be conducted quite satisfactorily in that city. There are banking facilities, and while not so complete as some might require, there is rarely any difficulty in selling or buying the exchange required.

Dry goods and hardware, machinery of various kinds, and many staples can be carried in stock in Para without much danger, other than of rusting in the damp climate. One sees dry goods from Europe, particularly England and Portugal, and supplies of all kinds that could as well have been supplied from the United States. There is apparently no prejudice against the United States. In fact it might have a slight preference, other things being equal.

WRONG BEGINNING IS HARMFUL—A SUCCESSFUL CASE.

American machine makers do not stand by their machines. Automobiles have been sent to Para that did not perform the work expected. This was not due to any defect, but because the machine was new, not understood, and there was no one present to adjust the part or parts at fault. One poor automobile lost the sale of a dozen, and French machines were shipped in to supply the demand. With the first French machine came a machinist. Before the car had been on the streets a week the agent had cabled for five more, and other sales quickly followed.

One gasoline launch was sold from the United States, and owing to the fact that batteries exhaust quickly in this climate and no one knew just what the matter was, no more American launches were sold for quite a while, but foreign ones came in, and before the business could be turned back to America a dozen foreign ones were at work. These foreign machines were sold because every mechanic who had worked on one became of service to every owner of the others, and each such mechanic was an advocate, not of a machine he was financially interested in, but of one he could make work and keep in operation. More parts, greater complications, and higher cost cut very little figure, the availability of the machine when required making its greatest value.

Here is a case in point. Small power kerosene engines or gas engines were needed by many small concerns, for bakeries, coffee mills, and many kinds of work where from 8 to 10 horsepower was required. An agent sold one machine and a mechanic came with it. The agent's profit on the machine was about \$300, and it cost him \$1,000 to bring down the mechanic. He had this mechanic at once teach

two men to run the engine, and then started out to sell more, promising to furnish capable men to run them at once, and to keep capable engineers within call. He has now 70 of those engines running in Para and at upriver points. It is the only engine well known and called for by users, and there are many men familiar with running them who are always available.

HOW TO PACK FOR NORTHERN BRAZIL.

Engines and their parts have to be shipped in. The cases in which they are shipped are more valuable than their cost. The nails are saved and the straps binding them are carefully put away for future use. The oil for the engines, the tin cans holding it, and the cases holding the cans all have to come and are valuable. Here is a case where the value of the package has much to do with the future ordering of the same class of goods. Boxes are not burned or thrown away, as they are too valuable, but are stored in premises secured for the purpose at high rentals. Barrels of all kinds are worth more than their original cost when they get to Para, but care should be taken to see that the packages are good enough to be used again, for if the package is damaged on arrival the goods it contained may be impaired, and its second-hand value be lost to receiver.

For instance, oak flour barrels with hickory hoops are worth here twice their cost in New York, while white-wood barrels with flat hoops and head linings that split are not worth a cent and frequently cause rejection of the original shipment. The oak barrel can be used for shipment of many articles, such as crackers, sugar, groceries, and food supplies that rats might destroy if in a less secure package. It is ready for a 1,000-mile trip to Manaos, thence for transshipment 1,000 miles up another river, thence around a portage, and in a canoe for 500 miles farther, and when the buyer finally gets it the contents have cost him tremendously, but the goods are in usable condition. Hard-wood boxes well strapped will stand a dozen hard handlings and a few falls from a sling, but when the goods arrive in good order the high cost of the package is forgotten.

Do not spare the nails and do not use bright ones, but rather the cement-coated ones. Strap every case, if it weighs only 10 pounds, for the journey before it is not within the comprehension of the average shipping clerk. He may say that it is a waste of material and that the box could go to China and back, but China is not to be compared with the Amazon River for distance and hard handling of shipments.

FAILURE OF SUBSTITUTES—HIGH PRICES.

No one knows better what he wants than the merchant ordering goods for the Amazon River trade. Fill orders as they come, no matter how they may seem, as the purchaser knows his wants, and if the order is filled exactly as sent other orders will follow. This may seem unnecessary advice. Here is a case in point. A merchant in Para saw in a catalogue a kind of folding canvas cot, with mosquito net, which collapsed in small space when not in use and could be easily carried from place to place. He thought he saw a chance for trade in the cot and ordered a half gross, giving packing instructions. Imagine his surprise to receive some months later an invoice for another class of bed, at a different and a higher price, with a letter from the shipper saying that the bed which had been ordered was considered too light for the service and he had taken the liberty of

changing the order to a heavier bed with a mosquito net separate. When the goods arrived they were absolutely unsuitable for the purpose intended and could not be used for any other, as beds were not used at all where this heavy bed would have to be sold, people there sleeping in hammocks because cooler and costing much less.

Everything is very dear in Para, and up the river prices increase. Flour costs \$20 a barrel at points on the river. Shoes of ordinary quality cost \$15 a pair and beer \$1.25 a bottle at Manaos, 1,000 miles from Para, while something is added to the cost of each article for the next 1,000 miles. Every stick of timber, every nail, the tiles for roofing, cement, paving stones and curbing for the streets, hardware for buildings, glass, paint, and putty, and all articles of human requirement had to be shipped in, and are still required, because nothing originates or can be supplied along the Amazon River or its tributaries except rubber. Food of all kinds, liquors and all fluids, except the river water, come from a distance. The course up 3,000 miles of any of these rivers show only banks of impenetrable jungle running indefinite distances back from the river. In this jungle are the rubber trees and the people gathering the gum. The supplies for them must come vast distances, be transported on the backs of men, in many cases after long canoe hauls, and consumed as sparingly as possible.

DEPENDENCE ON OUTSIDE WORLD.

Para is a fine, clean, well-paved city, with a good water supply, excellent trolley service, and beautiful parks. One might well imagine himself in any city of Europe. The paving blocks in the streets cost 8 cents gold each, and the curbing costs in proportion. All the houses and the furniture, clothing, and food within them had to come to Para in a steamer or sailing vessel.

American exporters can obtain much more trade in northern Brazil than they now have by going after it. Salesmen should be sent to Para prepared to remain long enough to see everyone interested in their lines. Business can be done early in the day, from 7 until 11 o'clock, when breakfast is eaten. It is better to make appointments for the afternoon calls, as merchants frequently take a siesta after breakfast.

Portuguese is the language, but one can do very well with Spanish. To try to get along with English will make very hard work of what would otherwise seem easy. Cheap goods for the river trade are required and price is considered first in all articles of wear. After that comes quality, but high-class goods will find slow sale except in the city of Para and possibly Manaos. Fine clothing is worn, to a large extent, but it appears to be the practice with those who can afford the best things to make occasional trips to Europe or to the United States, with the women of the family, to lay in supplies. Some of the better stores in Para carry the finest class of European goods. Picture hats from Paris at \$100 to three times that price are to be seen, and beautiful boulevard patterns of silks and high-class dress goods are carried in stock. The rubber business has its "ups and downs," and when rubber is up the amount of money in circulation jumps into thousands, and the finest goods are bought.

AMERICAN DISADVANTAGES.

So far as American news or American practices or American food or anything American is concerned, northern Brazil is as far from the United States as Asia. It is easier to go to Europe than to the

United States, and better boats are in the European service. European styles are followed and European goods are much better known, because the sizes, weights, and generally the prices are in the metric system.

In examining into cases of failure to get and hold trade from the United States, I discovered in every case that the loss in trade had been to manufacturers who had attempted the trade without an export organization in their establishments. This organization is necessary. The American export houses know better how to comply with the many little requirements of a successful export business than the average manufacturer, and unless these requirements are carried out exactly there is bound to be loss and trouble. There are details in the business with Brazil that do not exist with other export business. These can be explained by taking a concrete case. Frequently the duties are collected on the basis of weight. One dealer showed me some toys that had cost 24 cents per dozen in Hamburg. The duty on these, calculated by weight, was just four times the cost. With some goods the package counts, while it does not with others. Trimmings add much to the duty in some cases, and to lay down any hard and fast rule to fit all cases is impossible.

EXPENSES AND PRICES ARE HIGH.

The cost of sending a salesman to Brazil is considerable. The time lost in getting there and the actual daily cost while there will run into a goodly sum, but the trade is there to justify the expense. No self-respecting salesman can cover the northern Brazil trade at a less expense than \$12 per day. Hotel service will cost him not less than \$6. Ginger ale costs \$1.25 for two drinks. His laundry bill will be high. Linen-coated paper collars cost \$1.50 per dozen. Linen collars of old style, ordinary 3-ply English make, cost \$6 per dozen.

If a salesman attempts to entertain at dinner he will be fortunate to get up from table with a bill of less than \$25. Travel between ports in Brazil is mostly done on Brazilian steamers, and while many of them are the finest boats afloat, the cost is very high. Getting from the boats to the shore and then to the hotel is a matter separate and distinct from the other transportation. It is unique and requires commercial training of a high order in order to get the service well done at a price within reason. What is asked has no bearing at all on what will be accepted, nor can one tell of the value of the service by the price asked. It will cost with ordinary baggage at least \$5 to the hotel and the same back to a steamer, and perhaps twice that sum, depending upon the volume of the traffic.

These expenses are such as ordinarily would not be considered necessary by the traveling man in the north, but here he is at the Equator, the weather is hot, the humidity great, and if one gets warm he stays warm until night, so the questions of laundry work and having some one haul your luggage become important. I have seen only one salesman with an expense account as low as \$10 per day, which he explained by saying he had been ten days on one slow boat, which brought his average down, and it also brought his sales down. It is a poor country to which to send new salesmen. Only first-class men should be sent, and men who will not be afraid to take quantity when offered, for the quantities bought sometimes are great. One salesman had a new line of cheap and well-made men's overalls. His house told him he could sell 4,000 dozen of them, and the first order he took in Para was for 10,000 dozen.

BUSINESS CAMPAIGNS—SALABLE ARTICLES—CREDITS.

With the view of suggesting something to the export merchant looking toward this field with longing eyes, let me say that it appears to me to be a very good way for, say, three houses handling noncompeting lines to combine in the matter of salary and expense and select a first-class man to work this field for them. Nearly all the importers in Para and Manaus carry general stocks, but they want such connections that they can order anything made anywhere and be sure of getting it at a fair price. A salesman with three or four lines will get his share of the business.

The lines of transportation from New York should be well studied, for there are several lines that do not stop at Para, yet visit many other cities. Rates of freight vary, and it would be well to learn all the details of the fluctuating rates.

Rates of freight vary and it may be well not to contract the freight up to close to sailing day, because when sailings of rival lines are coincident there are liable to be fluctuating freight rates, and it is part of the game to get the freight as low as possible.

A house entering this field should be prepared to sell anything any man may require. Engines, boilers, automobiles, dredging machines, cement-block machines, the cement itself, books, stationery, wheels, vehicles, jewelry, paints and oils, boots and shoes, brooms, hardware, axes and machetes, haberdashery, and cotton dress goods, in fact anything that may be called for from a country that manufactures nothing. In men's clothing, far more woollen garments are worn than one would expect to find at the Equator, and I account for it by the high cost of laundry work. Straw hats are always seasonable.

The trade is enormous, profitable, and should be gone after in earnest. The risk is small. In a country depending on one crop I do not recommend credit, as it is too speculative. It is not necessary to come into the north Brazil trade and offer long credits. Do business on short time, or, better still, against drafts, and sell the goods. Money will cost about 12 per cent at the banks, because it is worth it, and the risk makes the value of money here. Good merchants can at times get money for less than this rate. It may go as low as 8 per cent, but it must be very high-class paper to secure such a rate.

AMAZON RIVER FLOUR TRADE.

The flour trade of the United States with northern Brazil and the Amazon River country is losing ground and is likely to be still further reduced in the future. This condition is said to be due to the competition of the steamship lines, a factor in this competition being the subsidy granted by the Brazilian Government to a line of steamers flying the flag of that country.

Brazil has a coasting law similar to the law in the United States, forbidding any but Brazilian ships to carry freight from one national port to another. This situation with respect to transportation has resulted in a material increase in imports of flour from Argentina, and as the prices for the Argentine product have been lower than for American flour, much of the trade has gone to the former country, and it is doubtful if the United States can continue to compete successfully in the future.

A factor which affects this trade is the package in which this product is shipped. The oak flour barrel with 12 hickory hoops has

become a necessary trade product in Para and has a second-hand value sometimes reaching \$1.25 for the barrel, its heads, and head linings. These barrels are used for shipping sugar, and are in great demand for that trade and for other purposes. Their use has aided the American flour trade materially. If the price of wheat should be fixed by a standard reached by the world's markets, it is possible that the United States could hold this trade with northern Brazil. Under the present conditions the Argentine prices, being based upon exportable values, have a great advantage over the American shipments.

POSSIBLE MARKET FOR BARREL STOCK.

Pernambuco is the shipping port for much of the sugar of north Brazil. This sugar, mostly moscovado, leaves the mills in jute sacks for Pernambuco. In many cases these sacks are emptied in warehouses, and the sugar resacked in cotton sacks for export. Then much of it is slightly refined in Pernambuco and reshipped all over Brazil. Several million people north of Pernambuco and the whole Amazon River trade get their supplies here. Sacks are not suitable for that trade, as rats abound and are fond of sugar.

A good package apparently for the trade in question is an oak barrel with hickory hoops, to hold about 200 pounds, more or less. I was in a cooper shop where every man at work was sitting down. This attracted my attention and then I noted that men were cutting down staves and heads. A barrel with a 13-inch head and a 26-inch stave is required, being smaller than the ordinary flour barrel of commerce. All the shooks I saw piled up were the regulation length of 28 inches; the heads full size. The foremen stated that they could not buy the size of staves and heads wanted. I watched the process of setting up a barrel. By occasionally forcing in a narrow basswood stave, a very respectable 10-hoop barrel was turned out in about thirty minutes, after everything had been cut to size by hand for the cooper.

Those barrels sold from the shop at \$1.05 each, and sometimes as high as \$1.25, according to the demand and supply. Some dealer in barrel stock might get all this trade if he will make shooks the size wanted. The trade may not be large enough to justify a factory in changing its stock supply and running a lot of this small stock, and maybe material would cut to waste so there would be no saving in stocking the smaller package, but that cost seemed to me to be very high, and to offer a great chance to effect a saving and get all the trade. With sugar worth \$10 a barrel, there is 10 per cent of the value of the contents invested in a package that has very little value at destination.

In another shop were noted boxes made of absolutely clear lumber, three-quarters of an inch thick, tongued and grooved and dressed both sides, to hold 60 pounds of crackers. These boxes cost \$1.25 each. Larger boxes holding 90 pounds cost \$1.75.

TREATMENT OF AGENTS.

In Para I noticed a refrigerator made in the United States, and asked the price. It was double what it would cost at home. The dealer attributed it to the duties and freight, and I found he was right and that his charges quite justified the price.

He then informed me that the refrigerator I saw was the last of a dozen he had ordered, and he would get no more, because he had been badly treated. The manufacturers of the refrigerator had granted

him the agency for Para on his promise to throw out other stock and push that one article. After he had sold about a dozen he found that his neighbor across the street had one of the same refrigerators exhibited in his shop. He at once wrote the manufacturer, who replied that the complaint had been looked into. An export house in New York had sent them an order for two of the refrigerators, which they had filled, but they had not known the destination of the goods. They regretted that they could not prevent such things, and could not agree to prevent it in future.

It seems to me that the manufacturer should have made his word good, and upon receiving the complaint from a customer to whom the agency had been given should have sent him a check for a commission on the sales that had gone into his territory, even if the maker did not know they were going there. A commission and an explanation, with a promise to make the competition as light as possible, and a courteous letter would hold a buyer nine times out of ten. Moreover, such action makes the American manufacturers' word good, and that is much. Anyone can fill orders for specialties after they are introduced. The difficulty is to get some one to introduce them, and the manufacturer should appreciate that fact.

SMALL MACHINERY PLANTS.

In all the cities in north Brazil, including those on the Amazon and its tributaries, there is much café life. The climate is hot and sultry, and not conducive to activity. Coffee is taken frequently during the day, and is always hot and fresh at the cafés, which have a large patronage. The first breakfast of everybody is a cup of coffee with a piece of bread. An orange and an egg cost 35 cents each.

In common with others, I patronized the cafés, found one that was always busy, and will recite its history to illustrate the point. Six years before my visit the proprietor, who had been a waiter and had saved a little money, decided to start his own café. He selected a good location and bought his coffee, tea, bread, and sweet cakes, which he arranged tastefully. The business grew, and he found he could save money by putting in a small coffee roaster and grinder, to supply his own demands. He sent to New York and got a small plant for \$2,500, paying cash. He prepared the coffee so well that he was soon supplying his customers with pound packages of ground coffee to take home. His cake business was so large that he found it to his advantage to install a small bakery back of the café. This branch did well, and he added a small chocolate mill to grind the paste for his own use. Then he made a few crackers, found money in the trade, and was induced by a good salesman to borrow some money and put in a reel oven to bake his cakes and crackers, and it had so much capacity that he added bread to his output. Then his cracker business grew and he had to make boxes to ship them in, and he added a little box factory. He has kept adding to his machinery until he had quite \$50,000 invested within the few years mentioned. He buys his flour of importers, his coffee of the growers or dealers, and still runs the café, which is liberally patronized. He paid for every piece of machinery as he bought it.

There are dozens of such concerns growing in north Brazil, and will be for years to come. Their orders are small but they are continuous and are worthy of consideration. If exporters in New York

want small orders filled for north Brazil the manufacturer makes a mistake if he does not fill them promptly, as the more goods he gets to work the more orders he will have.

QUANTITY CONTRACTS IMPOSSIBLE IN BRAZIL.

In visiting several bakeries in cities in north Brazil it was noted that almost all the machinery used was of English make, particularly the boilers and engines of 15 to 20 horsepower. Only an occasional piece of American machinery could be seen.

An endeavor was made to ascertain why so much English machinery was being supplied, in view of the high-class machinery made for that purpose in the United States. To my surprise the dealer who was interviewed knew all about the American machinery, was favorable to it, and had actually visited the United States and seen several manufacturers about taking their agency for his field, but in each case he was confronted with the demand for an order for a specific number of the machines before the agency would be given. In case of the boiler and engine firm, they had demanded an order for 10 boilers and engines before placing the agency in his hands. Finding this impossible, he continued his journey to Europe, and in England found what he wanted, was offered the agency without any guaranty as to quantity, and had actually placed an order for 14 of the combined boilers and engines, with many more in prospect.

The advantage accruing to the manufacturer whose goods are well known is great, as prospective buyers of the machinery are assured of getting operatives familiar with it. Bakers, coffee grinders, sawyers, and others using the machines are quite dependent upon operatives, as only in rare cases have the buyers any practical knowledge. It was a mistake for the maker in the United States to insist upon an order for any number of machines at one time. In this climate machines rust quickly, become dust and dirt covered, and look badly after being held in cases for any length of time. If the machines have merit it is well to introduce them one at a time, as one machine doing good work in a factory is a better salesman than half a dozen in cases awaiting buyers. Those English machines are doing good work. They stand hard usage and would be very hard to displace. Each outfit represented about \$10,000 investment, and in the aggregate was worth having.

RIO'S INFLUENCE ON BRAZILIAN TRADE.

Exporters and manufacturers desirous of trade in South America should visit Rio de Janeiro. It is very much like Switzerland—for one cannot exaggerate its beauty. All is here—the beautiful location, the well-planned city, the well-paved streets, the lovely vistas, the Avenida Central with its millions of dollars' worth of modern buildings, and the harbor improvements that will cost millions and lead the world.

The city is justly the "mecca" for all good Brazilians. At intervals more or less frequent they all come to Rio. It is a good place for those desirous of reaching the people to present their goods. Everything can be bought in Rio, from fresh imported fruits all the year round to the richest silks and laces and diamonds. Things are dear beyond belief, and it is easy to understand why the Brazilian, buying in Broadway, New York City, regards the market as a very cheap one, and explains why he gets the reputation of being such a grand

spender. If the United States could only attract more of them it would be greatly to the interest of enlarged retail business and help wholesale exports wonderfully.

I was much impressed with the very small trade the United States has with Brazil, in the way of selling goods. The United States buys enough of Brazil, but does not sell that country half enough, and it was my business to find out why. I went looking for American houses and found only a very few. All the large foreign houses were either English, German, or French. All the shoes, silks, cotton goods, and fancy articles in the store windows were of English or German make, about equally divided except in the case of shoes, and they all appeared to be French. In a side street I found one dealer with a small stock of American shoes for which he asked \$9 a pair for the ordinary \$4 shoe. The price of a quarter pound can of baking powder was only \$1.08, because they were closing out stock. I rode over the splendid trolley system looking for American investments and could not find them. All the banks were English, German, or French.

NEWS FROM THE UNITED STATES.

Every morning I read the Journal of Commerce, the best commercial paper published here, and naturally looked for cable news. There is always more than a page of cables, a column from England, another from Germany, the balance of the page divided among the other European countries, while in the corner I found the United States news. There were three items the first morning, one of a lynching case in Florida, one of a railroad accident in Indiana, the other telling that a certain actress had secured her divorce. The next morning I found three more cables, one telling that the Italian Government was going to investigate the killing of the Italians, the next corrected the number of killed in the railway accident, and the third told of a fire in New England which destroyed a half million dollars' worth of goods. Every day since the United States has had an average space of 4 inches in the foreign cables, with matter about like the items mentioned. Yesterday were reported two failures of commercial houses.

It might be a good idea to revise the cable news that goes out from the United States to this field. Something besides riots, murders, lynching cases, divorce proceedings, failures, and railroad accidents may prove of interest, and it will certainly advertise us better. Is it not possible for some of the manufacturers' associations to get up a Press Club and arrange to have better matter sent on the cables? It is of the greatest importance that the United States should stand well with these people, who are all friendly and desire to know us better, but are evidently waiting for the advances to come from us.

The European cables were interesting reading; they told of the doings of royalty, the flight of new air ships, the trial trips of war ships, mentioning the builder's name, a test of some cement experiments, showing which of the foreign cements gave the best tests, mentioning names, told of trade conditions in Manchester, Birmingham, Hamburg, and Frankfort, discussed trade possibilities in coffee and other articles with European markets, mentioned prominent Brazilians at the moment in Paris or London or Berlin, and were interesting, with no evidence of padding by news bureaus.

The United States is the largest buyer of Brazilian coffee, yet it had not a line in the cables from that market. "Prices nominal" was all that was said after New York in the price column.

THE SITUATION AS TO AUTOMOBILES.

Of the automobiles I saw on the streets, I counted 90 foreign machines before I saw one made in the United States, and it was a cheap runabout, limping home on three tires. Inquiry shows that there are nearly 500 automobiles owned and registered in Rio, and I doubt if 5 per cent of them are of United States make. Every carriage I saw was European. I did not see one American-style carriage while in Rio de Janeiro.

An American at my hotel was running a high-powered, high-priced German automobile, and I asked him why he had not bought an American machine. He told me because the American makers would not stand by their machines as the European makers would, and he could get no guaranty from American makers. First of all, the American cars are not built on the metric system, and duplicate parts could not be made by local machinists. Again, makers in America would not guarantee to keep parts here, so he was forced to buy a foreign car. He had a positive guaranty from the agent that he would keep in stock at all times every part of the car, and in default of being able to supply him with any part on demand he would furnish him with another car to use without cost until the part was supplied. It is easy to see why any person would buy the foreign car under those circumstances. The agreement was good for five years, as the agent had a contract for that period from the makers of the car.

I doubt whether American builders would make a five-year contract with any agent abroad, as they look at the export business differently and would like to be in a position to change agents if sales should fall off. European makers evidently figure that if sales fall off the machine has something to do with it and calculate to keep their machines at such a standard that sales will increase and agents will keep up their interest in the cars. Changing agents does not necessarily increase sales. The European maker figures on the contrary. There may be something in the foreign business that our American makers have not yet clearly understood. It is very clear that metric-built cars will sell in South America in preference to the English system, prices being equal.

BENEFITS OF PARCEL-POST SYSTEM.

The recent establishment of a parcel-post system between the United States and Brazil should stimulate the business of American retail merchants. Catalogues sent to this country should be in Portuguese. It is useless to send them in any other language. English is unknown, Spanish is not their own tongue, and the cost of an edition of Portuguese catalogues is no more than an edition of Spanish.

The parcel-post system opens up great possibilities for retail shoe houses, for elegant shoes are worn. Gloves are worn largely, as the weather is cool part of the time, and never as hot as New York in August. Laces and embroideries, ribbons and silks, and fine men's wear will sell readily. Perfumeries and powders, silk stockings for both men and women, and fine underwear are in demand. All Brazilians are not rich, but Rio is the place to which all come when they have much to spend. French and English woollens are largely worn by men, and as well-dressed men can be seen in Rio as in any capital of Europe. Evening dresses and beautiful hats for ladies can be sold, provided the buyers here can be satisfied that the style is as late as they could get from Paris. The cost is immaterial. Put the style into an article and the Brazilian lady, like the American, must have it.

AGRICULTURAL MACHINERY.

I saw good stocks of American agricultural implements in several stores, and was informed that the trade was increasing rapidly, as the American goods were the best in the market. Agriculture is receiving much attention at the hands of the Brazilian Government and every inducement is being made to encourage immigration of farm laborers from Europe. Labor is scarce, and to open up the back country will require millions of workers. There will be an ever-increasing demand for implements from the United States. Cotton-working machines will also be required. At present the supply is coming largely from England. Sugar machinery comes almost entirely from England. The United States can do the business, but it will be necessary to make the investments here and have the goods ready to deliver when wanted.

A machinery agent here was told of half a dozen firms making good machinery in the United States who wanted good agents to represent them. They were all well and favorably known, and could give exclusive territory rights to the man who could get the business. He asked if the concerns were ready to send stock here and make a display from which orders could be taken, or the actual exhibit delivered if required, and was informed it was the American practice to have an agent come under advance for his stock, as manufacturers generally seemed unwilling to carry the agent's stock as well as his credits. He then said very plainly that he was not interested in taking such agencies, as his time was money to him, and he had had too much experience in trying to introduce goods 5,000 miles away, with rapidly fluctuating markets and demand. He said he could cite cases where he had sold machinery for American concerns exactly on their terms, and that they had been unwilling to allow the goods to leave New York without the money being on deposit to meet their sight draft against documents. New machinery could not be sold here on any such terms. Furthermore, any buyer had the right to see that he had received what he had bought before he had paid for it, and how could a man know that his orders had been filled correctly 5,000 miles away. He said that his shop was visited by people living far in the interior. They liked to look over new machinery and see for themselves if it would answer the purpose for which it was intended.

SELLING METHODS.

This dealer was willing to guarantee to sell such machinery as he ordered, so the risk of having the goods remain unsold was small. He did not want lines which he could not sell, as he knew his market too well for that. This dealer showed me his stock and assured me there was not a machine on his floor that had been there six months. Engines, machine tools, boilers, cleaners, lathes, and such things he carried, yet he said he must have a sample machine on hand, and he expected the makers to ship it and keep it entirely at their expense. He paid the store rent and freight and deducted his charges before remitting. He said also that he made the selling price in many cases, as he knew his market.

Evidently the manufacturer wishing to enter the Brazilian market must visit the cities and work out his own scheme for distribution.

American goods are well liked, and no person with whom I have talked has said aught against the quality of anything we have shipped. It seems to me to be certain that we can hold our position in any market if we get in right, for quality is of prime importance. The

Brazilian is European in tastes, in education, and in business. The ship that brought me to Rio de Janeiro had over a hundred returning Brazilians who had been to Europe to spend money and have a good time, and over 3,000 pieces of baggage were landed from the steamer at Rio de Janeiro, so they had some goods with them.

WHEAT AND FLOUR.

The United States in times past has done a large business in flour with Brazil, but it appears the volume must grow smaller with each year until it finally vanishes.

The United States was buying so much more of Brazil than Brazil was buying of the United States that a preferential duty was granted on flour and some other articles amounting to 20 per cent. This preferential is in force now, against Argentina as well as others.

The duty on flour is 25 reis per kilo, or about four-tenths of 1 cent per pound, and as part of the duty is payable in gold and part in currency it makes an interesting calculation. At the rate of exchange now (September, 1910) prevailing the rebate enjoyed by flour shipped from the United States is close to 19 cents per barrel. With the low rates of freight prevailing from Argentina this rebate is not enough to allow any business from the United States to be done south of the city of Bahia. We can not do anything at all in Rio de Janeiro.

PROTECTIVE POLICY.

Brazil has been endeavoring to build up a national industry in milling, and to do so has offered inducements for the erection of flour mills, which must be protected. If the question of preferential should be reopened at this time, it is said by those who know that much opposition would at once be brought to bear by local millers to have the entire preferential wiped out, on the ground that it would likely injure the national industry.

Brazil is not raising enough wheat to feed the country, and must import both wheat and flour until she does. The imports of flour have fallen off and those of wheat have increased, so the millers can justly claim that their industry is entitled to support and encouragement. In years when Argentina has a short crop the business from the United States in flour will increase, and should Argentina experience a crop failure all the trade of Brazil will come to the United States unless the local mills are able to import wheat from Canada or Australia or India to compete. The local mills would hardly be expected to shut down, but they could not run so heavily as to supply other than home trade, leaving the outports north of Rio to the United States.

With exchange as it is now the local mills enjoy a very prosperous period, as their wheat is shipped from the River Plate and paid for in foreign coin, local money being now worth quite 20 per cent more than the foreign. As all the flour and by-products are sold in Brazil, the profit is large.

FLOUR FROM ARGENTINA.

Argentina is shipping about all the flour imported into southern Brazil. That trade geographically belongs to her, and the freight rates will so favor her that she can take away from North Brazil the trade now held by the Brazilian mills and the United States. Boats run direct from Buenos Aires to Manaus, a thousand miles up the Amazon, and when the new line starts into that trade in October it is said that a rate will be made that will attract the business.

The Brazilian imports of wheat and flour for the five years up to 1908 are here given.

	1904	1905	1906	1907	1908
Flour.....barrels..	1, 472, 246	1, 578, 252	1, 727, 720	1, 911, 831	1, 700, 000
Wheat.....bushels..	7, 168, 900	7, 936, 366	8, 579, 200	9, 142, 710	9, 627, 688

It is stated that the imports of wheat during the last fiscal year will run considerably over 10,000,000 bushels, while flour imports will be about 1,500,000 barrels.

Taking those figures, they do not indicate such an extraordinary consumption of flour for a country with 20,000,000 inhabitants, and the increase in consumption will doubtless follow the development of wheat raising in Brazil, for it is the unquestioned policy of the country to live within itself as much as possible. Brazilians have told me it would be possible for Brazil to erect a tariff wall and keep out everything, as the country is capable of producing within itself every possible human requirement. It is larger than the whole of continental United States, with 3,250,000 square miles of territory and a population of about 6 to the square mile. It extends from a little north of the Equator to 33° south latitude, so it is probable that the claims for the wonderful agricultural advantages are justified.

URUGUAY.

No business man can visit Montevideo without being favorably impressed with the people and the seriousness of the merchants and importers. High-class business is evident along the docks and in the immense quantities of merchandise being unloaded from a dozen ships lying close at hand in the well-protected harbor.

Montevideo is just far enough south of the equator to be able to use very many of the articles of household comfort that can be shipped from the United States. The houses are built of heavy material, the walls being very solid and substantial, and it seems possible that American reinforced-concrete construction could be introduced to good advantage, as building cost would be greatly reduced.

Interior decoration is a feature worth considering. Wall papers are largely used, and water paint or kalsomine could be sold in large quantities, as housekeepers could be dealt with direct if the goods were offered in packages, as in the United States. The field is very large for a good class of material, and illustrated books published in Spanish may be effectively used.

Hardwood floors can be sold, and with them the appliances for keeping them in order, such as weighted brushes, wax, and polishes of all kinds. Tiles have been used largely, but can be easily displaced with fine-patterned hard-wood floors. Designs should be exhibited and samples of finished woods placed in hands of agents.

Very few houses have any facilities for heating, as grates call for chimneys and for coal, and both add to the cost beyond the amount of comfort derived. Now that good gas stoves and kerosene heaters are so low in price, there is no reason why a very large business in this class of heaters should not be done in Uruguay. It will be necessary to start in Montevideo, as all the back country will follow the lead of the capital. Wood-burning stoves can be sold well in the country, but the oil stoves that can be easily carried about from room to room

should be the best sellers. Rugs and carpets are used largely, but the supply comes from Europe. The styles are not equal to many American-made rugs, and a field exists for the sale of this class of goods. Kitchen furniture, agate ware, aluminum pans, and modern labor-saving devices can find a ready sale. Ranges for hotels and boarding houses can be sold. I saw a new range that had been hand-made at a foundry, and the cost was excessive, aside from the clumsiness of the appliance. There was no hotel range on exhibition at any of the hardware stores I visited.

SUBURBAN HOMES ARE INCREASING—GERMAN FURNITURE.

The streets are all well paved, wide, and the trolley system is so good that a large suburban district of detached private homes has been built up, and my observation leads me to believe that the same high class of goods can be sold in Montevideo for household use as can be sold, for instance, in Baltimore or Washington. The weather is not severe in Montevideo, but it gets cold and stone houses remain cold, and have a dampness about them that can be eliminated by the introduction of modern appliances.

The furniture is mostly German, massive and expensive. A furniture dealer told me the only reason he sold German ware was because it was offered him regularly and he had always handled it. He had no objection to American furniture, had seen several catalogues with inviting styles, but he did not buy from catalogues and preferred to patronize salesmen who knew what the market required, and could supply him with reliable goods. There is a chance for American-made furniture, oilcloths, and refrigerators. In fact a well-appointed furniture store on American lines could do a fine business in Montevideo.

HABERDASHERY GOODS—WINDOW DECORATION.

Men's ready-made clothing is about the same in price as in the United States, and there is a field for the introduction of American-made clothing, including overcoats. Good material is required, as the men are well dressed, and there is also a chance for men's ties and fine shirts. Silk ties in bright colors are largely worn. American-made underwear and socks could be sold. American shoes should be pushed more actively, as there is a chance for their more liberal sale. Nearly all the stores carry European shoes, particularly for ladies' wear. They are both French and Austrian made, and my observation would lead me to say that they are a trifle wider than American-made shoes, with quite high heels, but on a wider last, to accommodate greater weight, as the women appear heavier on the average than American women.

Window decoration is an art well understood in Montevideo, and appliances for showing material can be sold. Display cases are largely used and one very inviting class of shops exists in Montevideo that does not seem to prosper in the States, and that is men's haberdashery sold in barber shops. The barber shop is installed behind a screen in the back of the shop, and with the barber is the bootblack and manicurist, while the front of the place is occupied by a finely appointed men's furnishing goods shop, the windows making an inviting display. This is a happy combination, enabling the barber to secure a location on a prominent thoroughfare, without having to pay out all his profits in rent, and making it convenient for the patrons, in case of need, to buy a tie or dress shirt or collar at a moment's notice.

LAUNDRIES, PIANOS, AND AUTOMOBILES.

So far as I could ascertain, there is only one steam laundry in Montevideo, but the hand-laundry work is very high class and, while high priced, is so well done that the industry is encouraged. This fine laundry work results in a large demand for fine percales and French madras and excellent shirt materials for men's wear.

Pianos come mostly from Europe. There was a fire in the custom-house while I was in Montevideo and I was particularly impressed with the fact that there were 90 pianos and 20 automobiles consumed. The automobiles were mostly European, and the pianos American. Altogether about \$1,000,000 worth of goods was totally destroyed. One make of American automobile is in the lead in Montevideo. It happened to be in the hands of a live agent who understood the car, and he made the first one go, and after that the business developed rapidly.

The laws of Uruguay, or of Montevideo, require that each automobile must be tried on the road by an official inspector before it is turned over to the owner, to see if it has all the necessary appliances for safety. After this trial, if satisfactory, the car is licensed. It appears that so many cars were received for trial that the inspector had to appoint assistants, one of whom was a foreigner. This assistant was put in charge of a new American car to try it out and before going a mile the car broke down and a new cylinder had to be cabled for, as no duplicate parts were carried in Montevideo for that make of car. The agent who had sold the car was indignant, and made the statement that hereafter only the chief inspector should try out any cars he sold.

TRUCKS AND WAGONS IN USE—CARRIAGE TRADE.

The vehicles are nearly all of English or home make, are far heavier than are necessary for the loads they carry, and are too high from the ground to be loaded easily and with an economy of labor. There is a chance for American-made trucks of 1 and 2 tons' capacity, built with a slant to the tail to facilitate loading. Such vehicles would gain the support of the truckmen. Heavy vehicles should be supplied with brakes, as there are hills about the business section of the city. The retail delivery wagon is a very high cart, with limited carrying capacity. Light delivery wagons would find a ready sale. The horses are large and could easily handle all that anyone would care to load into a delivery wagon.

Harness is mostly of English pattern, heavy, and well mounted, with brass trimmings. Leather wears well, and with lighter wagons American-made harness should be sold in large quantities. The horses all being heavy, rubber hoof pads could be introduced to advantage. I saw several horses with quarter crack starting in their hoofs. This is easily remedied on hard pavements by the use of rubber hoof pads.

Local wagon makers import most of their wagon parts from England. The hardware is massive, the springs being far wider and with more leaves than are required in the States. Almost every vehicle has springs, as I saw not over half a dozen carts on the dock with their loads on a dead axle.

There are many fine carriages in Montevideo, but very few rubber-tired vehicles were noticed. It is said that the pavement is so rough and hard that they wear out too quickly and are too expensive. If victorias and coupés were fitted with 1½-inch tires of rubber, they

would last quite as long as elsewhere. The pavement is what is called in America "Belgian block" and is no harder here than in the United States. The climate is not particularly hard on rubber. Rubber-tired vehicles are not in more general use because they have not been pushed. The city has just let a contract for 30,000 square meters of asphalt pavement to be laid, and this will be followed by more work of the same kind. European patterns of carriages are all that can be seen. The surrey or straight-sill carriage is almost unknown.

HARDWARE AND ASSOCIATED LINES—COMESTIBLES.

American hardware, machine tools, agricultural implements, dairy implements, coffee grinders, windmills, and washing machines are carried in stock by some of the importers. One dealer told me he handled American goods from preference now, whereas he formerly handled English-made goods. I asked him how it came about that he had changed, and he told me with a laugh that a few years ago an American salesman came to see him and talked so well that he gave him a small order, and one of the conditions was that the salesman would not sell any other importer in the town if he took the order in question. The salesman agreed, on condition that the importer would give him one afternoon in going over his stock and allow him to make suggestions. The importer said he agreed to this, not thinking much of it, but he admitted to me that the afternoon he spent with that salesman was one of the most remunerative he could remember, as the man went from one line to another and pointed out the faults or told where other lines were better and where they could be secured in the United States, and from that day he had increased his line of American goods. He had no fault to find with packing or terms.

The people of Uruguay live well. No more finely appointed bakeries or confectionery shops can be found anywhere. The bread is excellent, made almost entirely from Uruguayan flour, as very little is imported from Argentina. American candies can hardly be found, but all makes of English sweets in tins are sold freely. Very few American condiments are on sale. Canned goods come mostly from France and England, and potatoes are imported in 100-ton lots, in boxes of about 100 pounds each, from France. Butter is an article of home manufacture and is all sweet, not salted.

BANKING FACILITIES—FOREIGN TRADE—AGRICULTURE.

The people are very cordial and I did not hear a word of American prejudice. The number of American salesmen visiting the country is increasing, and no sentiment exists against goods from the United States.

There is ample banking capital in Montevideo. The money is on a gold basis and the dollar is worth about $3\frac{1}{2}$ cents more than the United States dollar, and the circulation seems ample. Interest rates for discount range about 8 per cent for commercial paper, the banks paying 4 per cent interest on time deposits on certificate for six months. Deposits subject to check all draw interest on monthly balances, but the rate rarely exceeds 1 per cent. The banks are English, German, Italian, and French, are all very finely housed and apparently prosperous.

The imports and exports of Uruguay very nearly balance and combined will run close to \$90,000,000 for 1,200,000 people. The principal exports are hides, jerked beef, and mate, the native herb

used as a substitute for tea. An extract of beef company is located in Uruguay and maintains an enormous establishment a few miles up the river from the city.

Uruguay has a delightful climate, and can grow anything with a minimum of labor. Sugar, wheat, cotton, maize, and alfalfa grow in abundance, but the country is suffering from a scarcity of labor. The state owns very little land and can offer no inducements to settlers such as are offered by immediate neighbors. Most of the land is owned in large parcels and is used to raise cattle. The wheat production is the lowest per acre of any large producing country, being 9 bushels.

I can recommend a strong effort for more Uruguayan trade. Conditions are wholesome, the demand is ample, the trade will grow, and there is no reason why the United States can not double its business, except lack of effort to get it.

ARGENTINA.

WHEAT AND FLOUR PRODUCTION.

If the country has the same average potentiality for producing food as land similarly situated in North America or Europe, it would seem that Argentina can support 100,000,000 people easily, as only small parts of it lie outside the Temperate Zone.

Sugar, cotton, and corn are grown successfully in the northern part; wheat, corn, and cattle in the central part; and cattle, sheep and horses, together with some grain, in the southern part. There are regions not any too well watered by natural rainfall, on which grain was formerly grown, but experience has changed this, and the natural grain belt is said to have been found in the Provinces of Buenos Aires, Santa Fe, and Cordoba, with Entre Rios occupying an advancing position.

GRAIN PRODUCTION—CLIMATIC CONDITIONS.

The harvest of 1908 was taken from 50,000,000 acres of cultivated land, which included 13,000,000 of acres in grass and alfalfa for forage purposes. Comparing this acreage with the census of 1895, it shows an increase of about 260 per cent in 13 years. In the same period Buenos Aires more than doubled its wheat area, Santa Fe fell off half, and Cordoba doubled its area, so that 1910 found Buenos Aires and Santa Fe raising 65 per cent of the wheat. There is a tendency to extend the wheat area to the south toward the colder section of the country, and the wisdom of this policy would seem to be shown, as the average yield per acre was formerly less than 10 bushels, while it is now nearly 12 bushels. It would seem that this increase was due to climatic conditions, as the methods employed are practically the same. The country responds to high cultivation, as yields of 40 bushels of high quality wheat to the acre are reported on well-cultivated lands.

Corn is raised to the best advantage in the same States where wheat is grown, Buenos Aires raising 45 per cent, Santa Fe 33 per cent, and Cordoba about 10 per cent. The yield of corn is about 17 per cent less per acre than in the United States. This may be due to the variety of yellow corn that is produced, it turning to a red corn under the soil conditions. It is very hard corn when dry and the berry is not large.

Certain natural causes must be assigned for the falling off of wheat culture in one section and its increase in another. It appears from

a study of the rainfall and temperature tables that great variations exist on the same parallel of latitude. As one goes west from the Atlantic Ocean the temperature becomes lower until the rise of the foothills of the Andes gradually wipes out the possibility of grain growing, turning the country into a range.

VARIATION IN LAND VALUES.

It is difficult to arrive at land values. Climatic conditions and the proximity of water have much to do with productiveness. By proximity of water is meant its nearness to the surface of the ground so that it may be pumped for irrigation and for furnishing water to cattle. The proximity of a railroad has really less effect on land values than the nearness of the water to the surface. Lands lying in the same district, with equal railroad facilities, frequently differ 50 per cent in value, the lands farthest from the underground water-course having much the lower value. Water is very necessary for the cultivation of alfalfa, and to this crop is due the enormous increase in the number of cattle, horses, and other animals raised.

The unit of land measure is the hectare, equivalent to 2.47 acres. In the Province of Buenos Aires a large tract of land was sold in 1909 for almost \$600 gold per acre, and in the same Province in the same year other large pieces were sold for \$10 gold per acre, with many sales of enormous tracts at prices between the two. One sale was made in the Province of Salta, in the extreme north, of 40,000,000 acres at 68 cents per acre.

I had a conversation with a large landowner, whose holdings amount to 6 leagues, or about 27,000 acres, which was nearly all under cultivation to alfalfa, wheat, or corn, and he said that he would not take \$5,000,000 for his possessions. He was native born, of Irish parentage, and his 50 years in the country had taught him how to select land. Enormous fortunes have been made from land and more will probably be made, but the system of settling the land is so different from that in the United States that some explanation may be necessary.

SYSTEM OF LAND RENTING.

The immigrants, who are largely from southern Europe, come with little cash, and generally rent land, say, one family taking 100 hectares and settling upon it for three years, dividing the net proceeds, after deducting the cost of seed, animals, and harvesting, with the owner. At the end of the three years the settler may have enough money to take a piece of land on a cash rental, furnishing all his own tools, animals, and seed, as well as erecting a shack for his family. Land is generally rented to such settlers for a period of three years, at the expiration of which time the settler is to leave the land sowed to alfalfa, or he may lease again for a like period, depending upon his success on that particular land. A piece of land that has been worked to crop by a settler is generally allowed to grow alfalfa if suitable for it, otherwise it lies fallow for four years and is then rented for a further period of three years to be cropped.

It will be seen from this that the yield of wheat to the hectare per year is subject to modification, for if wheat land lies fallow for four years after producing a crop for three, it occurs to me that the product should be averaged for the seven years. Statistics take no account of this, the uncultivated land simply disappearing from calculations while lying fallow.

The owner of the 6 leagues of land said he allowed 2 head of cattle, or 2 horses or mules, or 6 head of sheep to the hectare, although he admitted that the actual settler could keep many more cattle to the hectare and do well, according as he fed them other feed than the natural grass. Alfalfa must be grown to develop cattle raising into a satisfactory business; the natural grasses will not suffice.

It is calculated that any settler desiring to lease 100 hectares of land should have \$1,500 in cash for his supplies, besides enough to maintain him until his crop is harvested.

The price of wheat varies, as does the quality, and it sometimes happens that in a very dry year the crop of certain districts is of no use except for feeding sheep, as it is so withered that if cut and thrashed it has no value to the miller.

There are no statistics available of the farmers who have failed to make good or to secure a living from agriculture, but observation leads me to believe that failures among actual wheat growers are in excess of those in the United States. The secret of success in Argentina seems to be mixed farming and stock raising.

RELATION OF PRODUCTION TO EXPORT TRADE.

In 1909 Argentina exported more flour and wheat than the United States, which fact may lead to an erroneous impression as to the relative production of wheat in the two countries. According to statistics prepared by the United States Department of Agriculture, the wheat production of the world during the five years ended in 1909 averaged 3,336,788,800 bushels annually, of which the United States furnished an annual average of 692,823,600 bushels and Argentina 159,166,000 bushels. In other words, the United States during this period produced approximately 20 per cent of the world's wheat crop and Argentina about 5 per cent.

It is estimated that in 1909 the United States exported about 15 per cent of its wheat crop, while Argentina exported 80 per cent of its production. It is this difference in the proportion of the production exported that has led to the erroneous impression of Argentina's total wheat crop.

There are nearly 7,000,000 people in Argentina to feed, and the home consumption of wheat for flour and seed is about 1,000,000 tons, admitting a very close milling yield, so it will be seen that in a year of crop failures the United States will have a chance to ship flour to Argentina if the average reserve is not increased.

MARKET PRICE AND COST OF PRODUCTION.

The average sum received at the railroad station for a bushel of wheat of the 1909 crop in the Province of Buenos Aires was about 80 cents gold, but I am unable to ascertain the cost of production. Laborers are paid \$15 gold per month, harvest hands \$2.10 per day, head stackers \$2.50 per day, and thrashing-machine laborers \$1.70 per day for the season. A driver who furnishes his own horse and cart is paid \$4.25 per day, binding twine costs 10 cents per pound, and where the wheat is thrashed by the bushel the cost is 13 cents per bushel. All wheat sold is sacked and sacks to hold 70 kilos, or 155 pounds, cost about 8½ cents, and the sack goes with the wheat.

From these figures I conclude that wheat raising by itself would be and is unprofitable, but in connection with cattle raising and the growing of other crops will be continued in Argentina so long as labor can be had. Labor for farm work is a serious problem all over South

America, and much of it must be imported from Europe. Many such laborers in Argentina return to Europe after the crops are harvested and do not return until the following year.

FARMING METHODS—TRANSPORTATION.

An immense amount of money is invested in harvesting machinery, and the large farmer endeavors to do his work at the lowest possible cost in order to make his business profitable. Conditions, however, are much different from those prevailing in the United States. The plowing is shallow and there is not a careful selection of seed. The land is generally leased on crop shares for a period of three years, at the expiration of which time the tenant moves to another place. There are no storehouses, barns, or elevators in the interior, and all wheat has to be stacked in sacks at the station, protected more or less by tarpaulins. A sack of wheat weighing 155 pounds is heavy, and it takes two men to lift a sack and place it on the back of a third, who carries it to destination, drops it, and returns for another. The sacks are loaded on flat cars, covered with tarpaulins, and started on their journey.

Upon arrival at a terminal elevator, say at Buenos Aires, or Rosario, six or seven men are assigned to each car to unload. Two throw the sacks of wheat to a third man at the open side of the car; one man holds the bag on end and another on the ground cuts the strings and the wheat drops into the hopper by gravity. The sack cutter does nothing else, the empty sack being thrown to another man, who shakes it and lays it down. These men can unload four cars a day, and the work can not be done any cheaper without labor difficulties. The wheat is not cleaned until it reaches the terminals or is ready for milling or export. Cleaning Argentine wheat shrinks it considerably, but it is not milled before being washed.

Wheat growing in Argentina has to contend with many adverse factors. The climatic conditions are not right, the population is not properly distributed to induce intensive cultivation, the berry has too many enemies to withstand in the grasshopper, hail, heat, drought, poor sowing, and lack of fertilization, and last but not least is the great expense of getting the wheat to the point of shipment or manufacture.

QUALITY OF WHEAT.

Argentina is producing a high quality of wheat so far as gluten or protein is concerned. The best wheat sown in the country is the Italian seed, the next that from France. The berry, after the second or third crop, becomes darker in color, and if not shriveled is a fine milling wheat. It is very hard, will frequently show as much as 50 per cent of wet gluten, breaks easily, and gives up a large proportion of choice middlings on the second break, cleaning entirely on the fourth.

The berry is very much like the hard Kansas in appearance and will weigh when plump over 60 pounds to the measured bushel after passing the ordinary warehouse separator. No attempt is made to keep the varieties separate; even some durum, grown by Italians for their own use, gets mixed with other grades. I saw two varieties of bearded wheat, but my opinion is that the bald wheat from Italy develops under local conditions into the best milling wheat and is hardier.

FLOUR MILLS.

In Argentina there is no such thing as milling in transit. A miller pays the flat rate in and the flat rate out. There is very little demand for feed. In the interior, mill feed will not sell because the natural alfalfa growth will develop the cattle industry; the small miller can not ship his feed to the cities as there is no demand there; Buenos Aires does not use bran or middlings. Oats are fed to horses when working, but cattle, sheep, goats, mules, and asses must "rustle" their feed from the fields.

There are 24 States and Territories in Argentina, 3 of which produce 86 per cent of the flour made in the country, while 1 of the 3 does not make enough flour to supply its own population. The average consumption is 200 pounds per inhabitant, in round numbers, so that only 2 States produce more than they consume. Buenos Aires and Santa Fe produce the most wheat and grind the most flour, and they also contain 60 per cent of the population of the entire Republic.

The country mill is a local proposition. It shuts down when the local crop is a failure; it grinds what it can sell at home when the crop is good. There are mills in sections where no wheat is raised, the experiment having been tried and proved a failure. With the passing of the wheat production the mills failed, while if someone had unfolded the milling-in-transit scheme to the railroads the mills could have resumed business and given the roads some freight. Interior milling can not become an important business until a market for feed is secured.

LARGE MILL AT BUENOS AIRES.

I was courteously given permission to visit the large flour mill in Buenos Aires and the manager accompanied me over the entire plant. This mill, with its grain elevators, is a big concern, representing an investment of considerably over \$5,000,000 gold. The plant occupies a commanding position on the banks of the River Plate and has its own slips and docks, where 10 steamships can be handled at one time, and several trains of cars can be handled on the tracks in the yards. The fuel is coal and comes in shiploads from Wales, and stock enough is carried to allow for delays in transit. The plant maintains a fire department with the necessary equipment. Over 1,000 men are employed and the work is thoroughly systematized.

Last year the elevators unloaded from river boats and cars, cleaned, graded, and shipped by ocean-going vessels 1,500,000 metric tons of grain, besides handling the grain for the mill's consumption, which amounts to nearly 1,500 tons a day. The capacity of the plant is 12,000 barrels of flour daily.

The mills, of which there are three, a large and another small one for wheat flour and a third for grinding corn, run continuously, Sundays included, while in operation. The entire plant shuts down, but never for a very long period, when repairs are needed or other circumstances make it necessary.

The stocks of wheat, flour, and grain carried are at times enormous. There is storage for 3,000,000 bushels of grain and the capacity will soon be increased to 4,000,000 bushels. At certain seasons of the year a stock of 300,000 sacks of flour is not unusual, and a stock of

5,000 tons of feed is frequently carried. All high-grade flour is packed in 44-kilo cotton sacks, and when the sewer has finished with it and throws the sack on a belt carrier it is not touched again until it arrives at its destination, possibly a quarter of a mile away in the warehouse.

PACKING—SACK SEWING.

Every labor-saving device is employed in handling and every point that will prevent errors or at least reduce them to a minimum has been worked out to a nicety. The various grades of flour are packed in sacks, the printing on which is of different colors and each sack is sewed with colored twine matching the printing. A workman seeing a sack traveling on a belt at once knows its grade by the color of the twine or printing. Brands do not cut the figure that color does. A man need not be able to read to know how to classify material on its way about the plant.

The method of sewing sacks is noteworthy. I observed that the sewer took short stitches, went once across the mouth of the bag, then turned and crossed the stitches, and went back again to the starting point, making a close, doubly sewed mouth on the bag, which would break anywhere else before it leaked an ounce at the mouth. I commented on this as being the best sack sewing I had ever seen, and the manager said, "Yes, it took me a year to get that feature of our business right."

To secure the proper colors and the proper stitch and to make the sewing tight when finished were of enough importance to occupy some of the manager's time for a year, and now claims for short weight are unknown. All over the coast line the flour of this mill can be picked out by the color scheme, and every dock handler who carries a sack of flour knows that the red must be kept separate from the blue or whatever other color happens to be in evidence. In the coast boats stocks are carried to many ports and grades vary with each order, so this system reduces the possibility of errors.

All the flour shipped is insured "free of particular average," as the "all risks" clause is not in operation in South America, so the mill has to provide for claims against which, in many cases, the miller in the United States is protected by insurance.

EQUIPMENT OF PLANT.

The mill maintains its own laboratory for making chemical analyses of wheat, grain, feed, and anything else required. The French chemist was able to show me samples of everything I asked to see.

The whole plant is driven from a central power station in which are installed two large German-built engines of nearly 2,000 horsepower each, with rope transmission. Electricity is generated to operate dynamos in remote parts of the elevators and to light the electric oven in the laboratory.

The large mill is a Simon mill throughout, all the machinery coming from England. Rolls 5 feet by 10 inches are used and the system is very long except on the breaks. The mill is equipped with purifiers and centrifugal reels, but the small mill has plansifters installed. Throughout the mill, from the cleaners through the washing plant to the feed bins, the utmost cleanliness is observed.

The facilities for loading steamships, cars, trucks, and any other conveyance that may offer are exceptionally good. Stocks leaving

the mill pass into a warehouse, where they are checked, and then out into boat, car, or wagon as the case may be, so that a debit and credit system with manufactured stock is maintained.

The mill grinds and corrugates its own rolls, and prints its own sacks, the blank sacks coming from the United States and England. It is not unusual for the mill to have \$500,000 invested in sacks, which it buys and sells extensively.

FLOUR PRODUCTION AND EXPORTS.

The total amount of flour manufactured in Argentina in 1908 was 695,627 tons, of which mills in the city of Buenos Aires produced 213,100 tons, or 31 per cent. The following table shows the total amount of flour exported by Argentina and the amount exported to Brazil during the 15 years ended in 1909:

Years.	Total exports.	Exports to Brazil.	Years.	Total exports.	Exports to Brazil.	Years.	Total exports.	Exports to Brazil.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
1895	53,325	47,632	1900	51,203	37,938	1905	144,780	103,424
1896	51,732	49,129	1901	71,742	68,120	1906	129,000	114,784
1897	41,443	40,097	1902	39,040	33,039	1907	127,500	118,332
1898	31,933	30,586	1903	71,980	60,088	1908	113,500	99,232
1899	59,464	53,900	1904	107,298	84,619	1909	116,487	102,358

These statistics show that practically only in Brazil does the United States miller encounter competition from the Argentine flour manufacturer. The next largest customer Argentina has for its flour is the United Kingdom, but the trade is comparatively small.

Argentina has exported nearly 200,000 tons of bran annually for the last 5 years. The feed shipments do not indicate a very close milling yield. For instance, in 1908 less than 700,000 tons of flour were made in the country, and 208,000 tons of bran were exported. In 1907 and 1909 over 200,000 tons of bran were exported. In looking over the milling returns I find that the percentage of invisible loss in flour mills varies from 1 to 7 per cent.

MARKING SHIPMENTS TO ARGENTINA AND PARAGUAY.

The laws regarding the marking of packages destined for the Argentine and surrounding territory require the number of the package, the transfer point, the destination, and the weight to follow the shipping mark.

Case No. 56.



Via Buenos Aires.

ASUNCION.

120 kilos.

The weight may be given in pounds, but the metric weight is preferred. The weight must be stated on all heavy goods. This is because all freight on the river is unloaded by cranes, the capacity of which is limited.

It is preferable to mark packages on four sides, as then a mark will always be in sight. On delicate ware the word "fragile" is

suggested as being better than any other, as it means the same in a number of languages. Stencil marking is better than hand marking with a brush. Care should be taken that the mark is distinct before shipping, as packages rub together in a ship's hold and marks are liable to be erased or rendered indistinct.

Parts of machinery or iron should be marked with white paint. Care should be taken to concentrate the mark in as small a space as possible and have it distinct. To spread it all over a case is unnecessary and is liable to cause delay. As a case is taken out of the hold of a ship a checker of cargo takes each mark as the package goes over the side, and it is checked again by the dock man in the same way. The customs manifest must show each mark and the bills of lading must show each mark; consequently brevity is important and what is said should be plain. All cases must be strapped to bear the journey. Naturally a box containing 50 pounds need not be strapped with as heavy iron as if it contained 400 pounds, but the shipper should give the package the benefit of the doubt in any case.

CHILE.

The coast line of Chile is 2,700 miles in length and the country has an average width of about 140 miles. The southern part is formed of territory acquired from Argentina and the island of Tierra del Fuego, and this section now forms the Territory of Magellan; the remainder of the country is divided into 23 States.

The capital of the Territory of Magellan is Punta Arenas, the southernmost city in the world, with a population of about 12,000, good wharves and stores, paved streets, and extensive traffic. All vessels going through the Straits stop at Punta Arenas and much wool is shipped from there, as the sheep industry is large in the country tributary to the city. It is a free port, has a wireless telegraph station, is a station for the Chilean navy, and does a large business in the coaling of steamers. It is, in fact, a crossroad station between the East and the West. I had conversation with a dozen residents of the city and 10 of them asked me what effect the opening of the Panama Canal would have on the straits traffic.

TRADE STATISTICS—HEAVY COST OF DOING BUSINESS.

According to Chilean statistics, the trade of the United States with Chile in 1909 showed an increase of \$4,503,123, the imports into Chile being \$8,697,289 in 1908, and \$9,601,084 in 1909, and the exports therefrom to the United States \$16,050,387 and \$19,649,715, respectively. According to American statistics the exports to Chile from the United States in 1908 and 1909 were \$5,373,911 and \$6,787,537, respectively, and the imports from Chile \$12,494,122 and \$16,700,994. The chief imports from Chile into the United States are nitrates and minerals and the chief exports thereto are lumber, machinery, oil, and manufactures.

Business conditions on the west coast of South America are very different from those on the east coast; it is like passing from one continent to another. American influence is very slight on the east coast, while it is strong on the west coast. Trade in Chile is carried on at a very heavy expense, as the configuration of the country is peculiar and facilities for travel and transportation are limited. Trade must be gone after and but few visits can be made in a day. Train service is not frequent and on the coast the cities can be visited

only by the regular steamship service. It is not unusual for a salesman to remain a week in a little port city waiting for the next boat in either direction, while the business to be done could be transacted in a few hours. I was more impressed with the extremely high cost of doing business on the west coast than with any other feature.

No trade sought by the United States exporters requires the care, the all-around watchfulness, that this west coast trade does. If shippers could make a trip along the coast and observe the methods employed by the steamers and lightermen in handling merchandise they would at once improve their business methods or withdraw from the trade.

ROUGH HANDLING OF GOODS AT PORTS—PACKING.

With few exceptions the ports are open; that is, exposed to the full swell from the Pacific. In every port on the coast all classes of merchandise are discharged from steamers into open lighters or barges. These come out from shore on the arrival of a steamer, fasten to her with a bow and stern line, and swing clear, as the ocean swell keeps both barge and steamer moving, and their up-and-down motion is by no means coincident. The result is that a sling full of merchandise consisting, say, of a box, a barrel, a bale, and a crate, weighing perhaps 1,500 pounds, is swung over the ship's side and lowered to within 15 or 20 feet of the water, and when the barge and the swinging sling are exactly opposite down goes the merchandise with a rush to catch the barge. The package on the bottom receives the full force of the impact. The barges are towed to shore and the merchandise landed, much of this second handling being done in the open.

From the shore to the customhouse and through it to the merchant's warehouse the goods come in due course, and then the owner sees them for the first time. If they are damaged or short in count, there is sure to be complaint to someone, and it usually goes to the shipper. Suggestions as to better methods of packing have been made ever since shipping from the United States began, and improvements have resulted; but there is still room for betterment. Packing cases should be made of thicker material, barrels should be carefully headlined and then metal strapped, kegs of nails and other heavy material should be iron banded both ways across the heads, and valuable goods, such as shoes, dry goods, wines and liquors, cigars, and merchandise that is small in size or could be easily extracted, should be double cased or else double-end metal nails should be used to bind together the sides and top and bottom.

Owing to the loss of merchandise through pilfering from packages, shippers should use a thief-proof package or get as near one as they can and not increase the cost too much.

INSURANCE—RESPONSIBILITY OF STEAMSHIPS.

So far as insurance is concerned, the best I have seen written on merchandise was "Free of particular average unless the vessel be stranded, sunk, in collision, or burned." Very much is written against total loss only.

In looking into the matter of claims and the responsibility of steamships, I found no importer who knew of the Harter Act of February 13, 1893, which makes radical changes in the old form of bill of lading, as it enforces the liability of the ship for the carelessness of its officers, etc., and forbids clauses in ladings exempting vessels or officers from liability. Of course, a claim under the laws of the United States can not be

enforced in Chile, so I suggest to exporters in the United States, when their clients have claims against steamship companies for shortage or for loss through careless handling which they are unable to collect, that the claims be sent to the United States for collection.

Steamship owners are not infallible; their agents make mistakes, and it is the business of the agents to get their ships out of ports with as few claims as possible. Moreover, many of the ships bringing cargo to the West Coast from the United States are tramps under time charters, and inquiry proved that the greatest number of claims and complaints concerned cargo shipped on such boats.

It will be conceded by fair people that the cause of complaints is the system rather than any one factor. If packages were made stronger the handling would no doubt become rougher; good insurance can not be bought, and the consequent supervision on the part of insurance companies is lost; freight offers in such small quantities that only a few vessels can be kept regularly in the service, the surplus offerings of freight being handled by charters of the cheapest vessels, usually tramps.

BEST METHOD OF SEEKING TRADE—COMPLAINTS OF IMPORTERS.

In many lines, manufacturers who desire business on the west coast can not do much by seeking it direct. It is much better to use the available established channels. A number of excellent houses are engaged in distributing merchandise from the United States to Chile and Peru, the names of which are filed in the Bureau of Manufactures.

Owing to the high cost of doing business it is doubtful if any commission house could afford to handle it at the old rate of 5 per cent. Those with whom I talked were operating as merchants, having bought the goods, and they were charging a profit sufficient to cover all costs and insure them against losses. The American manufacturer can more easily sell to the merchant in San Francisco or New York than he can to one in South America, and he will be spared costs and loss of interest by receiving payment soon after shipment.

A frequent cause of complaint against the American manufacturer is that he comes into the market as a liberal or free seller, invites the interest and best efforts of the importers here, who establish a market for the line, and then suddenly withdraws, saying he has other markets that pay him better or that because of home demand he does not need the export trade, and when he does he will return to it. Many lines that might have developed an extensive business have been handled in this way. Cement in particular was mentioned. It seems that a brand had reached a large sale and had become popular, when the manufacturer made an important contract and was obliged to advance his price beyond that of competitors and thus lost the market.

It is clearly a waste of effort to enter this South American field unless it is the intention to remain in it.

WHEAT PRODUCTION—MARKET FOR AGRICULTURAL IMPLEMENTS.

Chile has raised sufficient wheat for its own consumption and sometimes for export for many years, and the manufacture of flour is a national industry, protected by the tariff.

The chief agricultural portion of Chile is what is known as the longitudinal valley, just east of the coast line and lying between

mountain ranges. This valley is about 500 miles long and from 5 to 30 miles wide. During a good season when there is plenty of rain this valley is one great garden, in which are raised grain, fruit, vegetables—everything, in fact, that is required by man. In 1909 the southern part of the valley suffered from a prolonged drought and the wheat crop will be greatly affected. Generally 1,000,000 to 1,250,000 acres of wheat are harvested, but the 1909 crop will hardly reach 10,000,000 bushels.

No figures are available showing the annual per capita-consumption of flour in Chile, but judging from the character of the bread and the standard of living it may reach 150 pounds. Consequently it would seem that Chile would require considerable flour from either Argentina or California before another season.

Club wheat, or Oregon white, is grown largely in Chile, although other varieties do well and make a stronger flour, for which there is some demand from Italians for macaroni making. Cultivation is not advanced, although farm implements from the United States are in constantly increasing demand. However, the area available for cultivation is not very large and the system of settling the farmers on the land does not seem to meet with favor, so that it now seems that the demand for agricultural implements can not become great unless the large holdings are cut up, offering homes for more producers as well as consumers. A scarcity of labor prevails in Chile.

Oats are raised for forage, barley for brewing, and maize for distilling purposes, and forage. Very little corn meal is consumed.

The great source of revenue in Chile is its valuable nitrate field, which seems inexhaustible, estimates as to the supply varying from 50 to 200 years. The mineral exports from Chile are increasing as the country is opened up and new fields exploited.

PERU.

Sentiment in Peru toward the United States is quite cordial, owing probably to the comparatively large investment of American capital in the country and to the number of Americans residing there. In proportion to population there are more American goods to be found in Peru than in any other South American Republic, and the field is ready for further development. Houses with American capital have large interests and are ready to bring in any class of goods desired by the constantly increasing American population.

While the coast line of Peru is barren, other parts are highly productive. A fine grade of cotton is raised, sugar is produced in sufficient quantities to allow for some exportation, vegetables grow abundantly, and wheat, barley, oats, and alfalfa sufficient for the country's requirements are produced.

CAPITAL AND EFFICIENT LABOR NEEDED—WARNING TO INVESTORS.

The one great necessity of Peru is capital; next to that comes labor. Although the country has produced treasure in untold quantities in centuries past, very little of the wealth has remained in the country. Minerals of many kinds are found in enormous quantities. Petroleum is found in the northern part in flowing wells. My journey from Callao to Panama was made in a first-class, well-furnished steamer belonging to Peru and using oil from these wells as fuel. Four more steamers of this class are under construction for the same company.

Peru has one mine that turned out 5,000,000 pounds of copper in the month of November, 1910, and improvements are contemplated that will nearly double the output. The quantity of copper available is stated by engineers to be practically inexhaustible, and with it come quantities of silver and gold. Nearly all the skilled labor employed about the copper plants is American, while the manual labor is performed by the natives, who are mostly of Indian-Spanish ancestry. This labor is the only kind to be had and is dear because it is not efficient.

A banker stated to me that the companies operating in both the mines and the oil fields were sound business enterprises, earning profits year after year, and all seem to be extending their holdings. An increasing number of people are entering the field, some coming as prospectors and others to buy and operate located properties. The policy of Peru is to welcome capital and protect it, but care must be exercised in selecting and purchasing land. The question of title is important, and prospective investors should consult those already located to learn of the difficulties that develop. Lands that have apparently been Crown lands from time immemorial, with titles seemingly perfect, are liable later to show up in some person's grant, made years before.

IRRIGATION AND RAILWAY PROJECTS—DEMAND FOR FOREIGN GOODS.

Peru contemplates large irrigation projects, which will open up great districts to agriculture. Many of the canals of the Incas have been allowed to decay, and in many the sources of water supply have been lost. The coast line is rarely visited with rain; in Lima it hardly ever rains, and all vegetation for that city and Callao grows under irrigation. Back from the sea, in the valleys in the mountains, the rainfall is in places sufficient.

Only recently the Chamber of Deputies of Peru voted to accept the modifications deemed necessary by the promoters of the Ucayalo railroad, which will now be built to connect the interior country, or that finding its outlet via the Amazon River, with the Cerro de Pasco Railroad, and thence with Lima and Callao. This road should bring much of the rubber, coffee, cocoa, and timber to the west coast and furnish cargo for the new steamers planned. Great quantities of what is known as Para rubber originate in Peru, but are marketed via the Amazon River because the few hundred miles to the Pacific have been impassable for merchandise. A railroad is to be built from Paita to Iquitos, opening up a rich country. It may be some years before this road is built, but portions of it have been surveyed and all that is lacking is capital.

Furniture is being manufactured in Peru from native woods, and there is a demand for woodworking machinery. The demand will increase as soon as timber from the interior can be brought to the centers of population where furniture is most in demand. Fully one-half the population of Peru do not require modern manufactures, as their earning power and education are not up to that standard. The Indian, half-breed, and peon do not buy much imported merchandise. The native cloths do him for clothing, very little answers for furniture, and the less property he has about him the easier it will be for him to move. In figuring the possibilities for business this class must not be included.



DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 46

COTTON GOODS IN SPAIN AND PORTUGAL

By

RALPH M. ODELL

Commercial Agent of the Department of Commerce and Labor

**TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD**



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LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE AND LABOR,
OFFICE OF THE SECRETARY,
Washington, December 4, 1911.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1912, approved March 4, 1911, a report by Commercial Agent Ralph M. Odell, of this department, containing the results of investigations of the cotton-goods trade in Spain and Portugal.

Respectfully,

BEN. S. CABLE, *Acting Secretary.*

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, September 25, 1911.

SIR: I have the honor to submit herewith a report by Commercial Agent Ralph M. Odell on the cotton-goods trade in Spain and Portugal. As the Spanish manufacturers practically monopolize the home market and as there is little opportunity for the sale of American goods, Mr. Odell gives special attention to the rise and progress of the domestic industry and the efforts of the manufacturers to increase their export trade, and especially to find new outlets for their products. Spanish cotton goods compete strongly in Latin America with products from the United States, and the information gathered relative to the Spanish industry and trade methods should be of value to American manufacturers and exporters.

Investigations in Portugal were along similar lines. The cotton industry and trade of that country, however, are both small, and more attention is given to general conditions and the methods that should be followed to secure for American manufacturers a greater share in that country's commerce.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

TO HON. CHARLES NAGEL,
Secretary of Commerce and Labor.

COTTON GOODS IN SPAIN AND PORTUGAL.

SPAIN.

GENERAL TRADE CONDITIONS.

Among the prominent nations of the world engaged in textile manufacturing Spain ranks last as an importer and next to last as an exporter of cotton goods. The table following shows the imports and exports of the various nations and the number of spindles in each. The figures are from the latest available statistics for each country.

Countries.	Imports.	Exports.	Number of spindles.
Austria-Hungary (1910).....	\$10,892,000	\$11,542,000	4,643,275
Belgium (1908).....	46,449,000	50,860,000	1,321,780
Brasil (1908).....	15,788,000	.....	761,616
British India (1910).....	103,260,000	38,606,000	5,657,231
Canada (1910).....	11,917,000	.....	855,293
China (1908).....	86,978,000	.....	800,000
France (1910).....	14,561,000	65,627,000	7,100,000
Germany (1910).....	32,944,000	87,857,000	10,200,000
Italy (1908).....	5,657,000	25,398,000	4,200,000
Japan (1908).....	5,817,000	19,455,000	1,948,000
Mexico (1908).....	4,644,000	.....	688,217
Netherlands (1910).....	22,503,000	23,052,000	426,354
Portugal (1908).....	2,995,000	1,807,000	455,696
Russia (1908).....	8,963,000	10,480,000	8,234,137
Spain (1908).....	2,217,000	10,947,000	1,850,000
Switzerland (1910).....	23,438,000	49,569,000	1,466,698
United Kingdom (1910).....	53,214,000	515,750,000	53,397,000
United States (1910).....	66,972,000	35,578,000	28,349,000

Although Spain supports a population (20,000,000 in 1910) one-fifth as large as the United States, its imports of cotton goods in comparison are less than one-twentieth as great. Practically the entire domestic demand for cotton goods is supplied by the native mills.

Spain's chief exports are raw materials, manufactured products occupying only a minor position. The country is rich in agricultural resources, but much fertile land is unproductive, owing partly to the lack of competent labor with which to cultivate it and partly to the absence of irrigation.

PROGRESS OF AGRICULTURE.

Cereals constitute the leading agricultural output, more than three-fourths of the land under cultivation being given over to the production of wheat, barley, oats, rye, maize, and rice. The annual wheat

production totals nearly 4,000,000 tons. Large quantities of vegetables and fruits (grapes, oranges, lemons, and olives) are grown and exported to various parts of the world. As an olive-producing country Spain ranks first, and one-seventh of the world's output of wine is produced in Spain.

In order to encourage intensive culture of the farms the Government began 10 years ago to establish experiment stations and to-day they are to be found in nearly every important town. At these stations the farmers are given instruction in the most scientific methods of tilling the soil, and the latest improved agricultural machinery is used. Under Government supervision large tracts of land formerly idle have been made productive through irrigation, and during the past decade the number of acres under cultivation has been increased by over 7,410,000. The use of chemical fertilizers, nearly all of which are imported, has increased considerably in recent years.

The fact remains, however, that to-day the use of agricultural implements is far less than it should be. This is partly due to the fact that many of the farms are small and the owners are poor, but Spain undoubtedly offers a splendid field for the sale of improved farming tools. The increase in the agricultural output of the country through irrigation and the use of fertilizers is gradually bringing the farmers to realize the need of more modern methods, and antiquated tools are being replaced by share plows, harvesters, binders, seeders, and thrashing machines.

The United States supplies more agricultural implements than any other country, the imports therefrom amounting to \$266,760 out of a total of \$680,220 in 1908. England ranks second and is followed by Germany. The United States furnishes plows, seeders, cultivators, mowers, reapers, and binders. Germany, however, is a strong competitor in the sale of plows, owing to the fact that the German article is cheaper. The farmers, however, have learned that it is inferior, and they are more favorably inclined to the American make. Thrashers are almost wholly supplied by England, owing largely to the fact that the British machines are provided with an apparatus for bruising the straw, thus making it suitable for use as food for live stock.

TREND OF FOREIGN TRADE.

The foreign trade of Spain amounts to more than \$375,000,000 annually. Almost without a break imports have exceeded exports in the past 10 years, as is shown by the following statistics of the total trade of the country:

Years.	Imports.	Exports.	Total.	Years.	Imports.	Exports.	Total.
1900....	\$177,559,370	\$150,501,990	\$328,061,360	1905....	\$195,779,151	\$178,896,837	\$374,675,988
1901....	169,812,095	142,292,724	312,104,820	1906....	190,096,227	168,765,086	358,861,313
1902....	165,890,615	153,114,482	319,005,098	1907....	179,527,258	178,555,363	358,082,621
1903....	175,654,537	170,276,115	345,930,652	1908....	192,663,795	174,509,204	367,172,999
1904....	171,976,046	172,203,961	344,180,008	1909....	188,999,848	183,465,655	372,565,503

Tariff duties in Spain are specific and are levied by weight, the values of the imports being determined by the customhouse authorities.

PRINCIPAL IMPORTS AND EXPORTS.

The value of the leading articles of import and export in 1908 and 1909 is given in the following table:

Articles.	1908	1909	Articles.	1908	1909
IMPORTS.			EXPORTS.		
Cattle.....	\$7,112,681	\$5,688,989	Almonds.....	\$3,420,006	\$4,712,873
Chemicals.....	11,311,518	9,711,494	Copper and brass.....	8,370,236	8,620,499
Coal.....	13,079,397	13,876,991	Cork, and manufactures of.....	7,781,909	5,950,485
Codfish and stockfish.....	6,914,791	6,611,239	Cotton, manufactures of.....	9,201,790	10,947,226
Coffee.....	4,023,289	3,977,396	Fish.....	7,296,013	6,866,742
Cotton, and manufactures of:			Grapes.....	1,801,871	2,438,795
Raw.....	25,634,528	19,689,499	Iron pyrites.....	3,245,769	4,353,170
Fabrics.....	2,209,240	2,217,766	Lead.....	13,297,088	13,308,973
Yarn.....	510,599	406,858	Olives.....	1,569,063	1,332,906
Hemp and flax.....	821,285	858,306	Olive oil.....	5,660,339	4,774,608
Iron and steel.....	4,941,815	1,381,523	Onions.....	2,648,984	2,069,965
Linen goods and yarn.....	814,601	762,901	Oranges.....	10,070,771	10,109,905
Leather and skins.....	5,112,327	4,546,235	Ores:		
Machinery.....	11,829,475	9,704,785	Copper.....	5,690,062	5,487,678
Wheat.....	2,985,672	3,631,385	Iron.....	16,319,154	18,404,723
Wood and lumber.....	8,068,217	8,492,589	Raisins.....	3,323,423	2,908,043
Wool, and manufactures of:			Skins.....	2,629,187	3,294,145
Raw.....	2,288,438	1,436,784	Wine.....	11,914,600	11,404,364
Fabrics.....	1,239,190	806,963	Wool, and manufactures of:		
All other articles.....	83,766,732	95,198,143	Raw.....	1,597,213	4,044,226
			Fabrics.....	432,369	526,361
			All other articles.....	68,239,377	62,862,968
Total.....	192,663,795	188,999,848	Total.....	174,509,204	183,465,655

From the foregoing it is seen that Spain's principal exports are minerals, cork, wine, and fruits, while the chief imports are cotton, coal, machinery, lumber, and chemicals. Buying raw materials from abroad, the industries of Spain transform them into articles for home consumption and for exportation. The importation of manufactured goods is rapidly declining and is confined chiefly to articles which are demanded by a particular trade and which it is difficult or impossible to produce in the country.

DISTRIBUTION OF FOREIGN TRADE.

The imports into and exports from Spain in 1908 and 1909 are shown, by countries, in the following table:

Countries.	Imports.		Exports.	
	1908	1909	1908	1909
Argentina.....	\$4,756,522	\$6,268,938	\$8,918,955	\$9,807,634
Austria-Hungary.....	1,545,340	1,475,164	1,033,508	725,027
Belgium.....	4,639,149	5,903,195	5,005,267	6,533,784
Brazil.....	2,077,454	2,130,082	447,924	238,126
Chile.....	818,518	957,771	650,958	1,061,566
China.....	452,016	474,074		
Colombia.....	111,728	159,418	342,129	644,807
Cuba.....	934,669	726,744	9,031,998	9,663,609
Denmark.....	405,875	558,585	1,030,247	979,239
Ecuador.....	911,106	577,268	274,147	233,523
Egypt.....	2,192,376	1,559,108	54,160	35,351
France.....	36,502,268	35,049,149	38,229,949	43,013,987
Germany.....	19,049,265	20,617,978	9,747,780	8,720,433
Italy.....	2,784,482	2,357,062	8,985,375	7,679,116
Japan.....	162,161	108,861	91,063	46,299
Mexico.....	1,047,824	626,624	1,968,965	1,721,062

Countries.	Imports.		Exports.	
	1908	1909	1908	1909
Netherlands.....	\$2,085,532	\$2,858,970	\$8,402,845	\$9,777,143
Norway.....	3,579,595	3,145,295	354,490	421,577
Peru.....	255,505	278,248	167,785	85,416
Philippine Islands.....	3,621,511	3,228,807	1,305,211	1,727,447
Portugal.....	10,480,118	8,687,879	8,781,729	8,729,558
Porto Rico.....	982,652	988,126	485,543	428,915
Russia.....	4,413,918	4,745,374	507,135	1,181,155
Sweden.....	3,104,979	1,880,605	260,724	205,087
Switzerland.....	3,142,388	3,052,411	1,024,983	1,176,238
Turkey.....	1,094,071	574,619	1,945,019	1,055,928
United Kingdom.....	35,441,520	37,128,468	48,023,005	49,080,154
United States.....	24,955,578	21,907,169	7,406,098	11,127,068
All other countries.....	21,204,365	20,265,844	9,407,320	8,867,205
Total.....	192,663,795	188,999,848	174,509,204	182,465,655

In 1909 the United States ranked third, both as a supplier of Spanish needs and as a buyer of Spanish products. The decline in imports from the United States in 1909 was due to a decrease in the amount of raw cotton purchased (\$4,231,321 less than in the preceding year). The world-wide stagnation in the cotton industry and a more extended use of Indian cotton caused a lighter demand for the American raw material. The increase of nearly \$4,000,000 in the exports from Spain to the United States was caused by greater shipments of minerals and metals, especially iron pyrites and copper in bars.

TRADE WITH THE UNITED STATES.

The following table, compiled from Spanish statistics, shows the value of the imports from and exports to the United States in 1908 and 1909:

Articles.	1908	1909	Articles.	1908	1909
IMPORTS.			EXPORTS.		
Animals and animal products.....	\$589,333	\$600,750	Cotton, manufactures of.....	\$51,005	\$61,610
Cotton, raw.....	19,190,999	14,959,678	Drugs and chemicals.....	263,333	176,589
Machinery and instruments.....	657,560	782,798	Food products.....	2,393,882	2,815,241
Petroleum.....	1,154,123	1,452,365	Metals, and manufactures of.....	1,779,714	2,924,072
Tobacco, leaf.....	250,735	484,438	Minerals.....	2,378,077	4,279,362
Wood, and manufactures of.....	1,657,819	2,221,414	Wood, and manufactures of.....	350,640	599,725
All other articles.....	1,455,009	1,436,720	All other articles.....	189,447	270,459
Total.....	24,955,578	21,907,169	Total.....	7,406,098	11,127,068

COTTON-GOODS IMPORT TRADE.

The insignificant amount of cotton manufactures imported by Spain is shown by the fact that in 1909 cotton goods formed only 1.17 per cent of the total imports. The bulk of the cotton goods purchased from abroad is supplied by England, Germany, France, and Switzerland, in the order named.

During the last 10 years there has been a gradual decline in the amount of cotton goods imported. This information was obtained from conversations with a number of leading importers, rather than from the Spanish statistics covering this period. One firm

in Barcelona stated that its importations of foreign goods in 1910 amounted to only 10,000 pieces, as compared with 50,000 several years ago, although statistics show an increase in 1909 over 1908. This seems due to the fact that the increased wealth of Spain enables the people to enjoy many luxuries hitherto unobtainable. This tendency has shown itself, to a certain extent, in the purchase of finer goods, the demand for which has not proved sufficient to make their production profitable to Spanish manufacturers.

COMPETITION OF FOREIGN AND DOMESTIC GOODS.

Goods purchased from abroad consist mainly of very fine linons, lawns, laces, embroidery, and novelties. Some of these are sold under an old established brand, like Victoria lawn from England. About five years ago Spanish goods began to supplant many of the foreign products, such as zephyrs, velvets, piqués, percales, muslins, and fine shirtings and prints. Although dealers liked the foreign goods on account of superior quality, they preferred the native products quoted at lower prices. However, such has been the progress of the Spanish industry that native goods compare quite favorably with those from abroad. One finds small quantities of English zephyrs in the shops about Spain, but these are handled chiefly by the haberdashers who cater to a fastidious trade and who use the goods in making men's shirts.

A close comparison of these goods and the native zephyrs does not reveal any great difference as regards quality, weave, texture, and finish. In fact, many of the goods advertised as English zephyrs are made in Spanish mills. In one shop I found Spanish-made cotton goods stamped in English, "Cambric, Superior Quality," and attached to the piece was a tag made in imitation of the kind used by the customhouse on imported goods. Any existing preference for foreign goods would seem to be founded on prejudice and a feeling that articles from abroad possess a particular excellence rather than on any real difference in quality.

CLASSES OF COTTON FABRICS IMPORTED.

In order to show more clearly the character of the cotton goods imported by Spain, the following table is given covering the imports in 1906 and 1909, the classification being that of the Spanish tariff:

Articles.	1906	1909
Yarn, colored or white:	<i>Pounds.</i>	<i>Pounds.</i>
Nos. 1 to 50.....	270,707	24,400
Nos. 51 and above.....	4,138	20,259
Sewing and embroidering thread.....	722,381	500,880
Twine and cord.....	6,281	12,317
Total.....	1,003,507	557,856
Fabrics, plain or twilled, unbleached, bleached, or dyed:		
Weighing more than 120 grams per square meter and having per 6 millimeters square—		
Not more than 20 threads.....	61,239	409,615
From 21 to 30 threads.....	35,543	140,030
Weighing from 80 to 120 grams, inclusive, per square meter and having per 6 millimeters square—		
Not more than 20 threads.....	971,227	133,284
From 21 to 30 threads.....	121,029	34,854
Weighing less than 80 grams per square meter and having per 6 millimeters square—		
Not more than 20 threads.....	70,831	91,988
From 21 to 30 threads.....	14,644	33,103

Articles.	1906	1909
Fabrics, plain or twilled, printed or manufactured of dyed yarn:		
Weighing more than 120 grams per square meter and having per 6 millimeters square—	<i>Pounds.</i>	<i>Pounds.</i>
Not more than 20 threads.....	11,270	98,373
From 21 to 30 threads.....	7,961	28,597
Weighing from 80 to 120 grams, inclusive, per square meter and having per 6 millimeters square—		
Not more than 20 threads.....	5,585	31,779
From 21 to 30 threads.....	7,198	21,076
Weighing less than 80 grams per square meter and having up to 20 threads per 6 millimeters square.....	1,861	6,551
Fabrics, figured in the loom, and weighing per square meter:		
More than 300 grams.....	11,686	26,140
From 201 to 300 grams.....	5,348	13,079
From 151 to 200 grams.....	3,436	12,665
Not more than 150 grams.....	3,614	16,973
Quilted, with raised nap, and the like, including blankets and Turkish towels...	21,179	14,324
Velveteens and other plush fabrics except carpets.....	7,700	125,334
Carpets.....	1,150	6,771
Fabrics for copying designs and bookbinding.....	34,780	92,884
Common fabrics stiffened with gum for linings and frames of hats.....	22,348	53,442
Tulle and lace, veils, etc.....	41,168	481,690
Knit goods.....	63,604	81,279
Trimmings and ribbons.....	115,097	224,620
Wicks for lamps and candles.....	20,072	32,516
Hunting and fishing nets and hammocks.....	19,023	108,279
Samples without value.....	314	635
All other articles.....	7,044	9,383
Total.....	1,685,951	2,329,564
Grand total.....	2,689,458	2,887,420

COUNTRIES SUPPLYING IMPORTS.

The share of the United Kingdom, Germany, France, Switzerland, and the United States in the cotton-goods trade is shown in the following table, which gives the imports into Spain in 1909:

Articles.	United Kingdom.	Germany.	France.	Switzerland.	United States.	All other countries.	Total.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Yarn, thread, etc.....	260,000	246,604	46,167	2,233	35	2,817	557,856
Cotton fabrics.....	659,395	115,656	199,139	65,637	5,306	67,298	1,112,431
Velvets and velveteens.....	24,424	60,834	34,803	2,624	.....	2,589	125,334
Tulles, laces, etc.....	80,806	145,266	68,450	185,554	.....	1,614	481,690
Trimmings and ribbons.....	7,889	162,965	43,183	4,538	473	5,572	224,620
Fish nets and hammocks.....	30,074	69,544	6,749	.....	103	1,909	108,279
Wicks for lamps and candles.....	292	4,582	27,361	176	.....	105	32,516
Knit goods.....	6,182	52,954	19,190	1,397	.....	1,556	81,279
All other articles.....	68,600	45,799	35,554	3,179	1,646	8,638	163,415
Total.....	1,137,662	904,204	480,656	265,338	7,562	91,998	2,887,420

England predominates in the trade in cotton fabrics and yarns, Germany in velvets, ribbons, and knit goods, and Switzerland in tulles and laces. The increasing share of trade, not only in cotton goods but also in other lines, that has been secured by Germany has been due to the perfection of its methods. Splendid banking facilities enable that country to offer long credits in competition with England and other nations. Salesmen with a thorough knowledge of the Spanish language are sent into all parts of the country to secure business and no order is refused, however small.

CUSTOMS DUTIES.

The strongly intrenched position that the Spanish cotton industry occupies with regard to the domestic trade is due in large measure to the protection afforded by the duties on cotton goods. Spain's tariff on cotton goods is one of the highest in the world, and it is one of the few cotton-manufacturing countries imposing a duty on raw cotton (others are Brazil, Russia, Italy, and Portugal). The duties are specific and are levied on net weight. The following are the duties on the principal kinds of cotton goods imported, conversions being made on the basis of peseta = \$0.193:

Articles.	Import duties per pound.
Cotton, raw, ginned or not, and cotton waste.....	1 \$0.114
Cotton, sterilized, absorbent, carbolized, and the like, unmanufactured or pressed.....	.044
Yarn, single, unbleached, for weaving, from No. 16 to No. 35.....	.066
Thread, unbleached, bleached, or dyed, prepared for sewing, embroidery, or knitting:	
Of 1 or 2 strands.....	.175
Of 3 or more strands.....	.219
Twine and cordage.....	1 2.19
Fabrics, plain, or twilled, unbleached, bleached, or dyed:	
Weighing more than 120 grams per square meter and having per 6 millimeters square—	
Not more than 20 threads.....	.153
From 21 to 30 threads.....	.245
Weighing from 80 to 120 grams, inclusive, per square meter and having per 6 millimeters square—	
Not more than 20 threads.....	.227
From 21 to 30 threads.....	.306
Weighing less than 80 grams per square meter and having per 6 millimeters square—	
Not more than 20 threads.....	.328
From 21 to 30 threads.....	.416
Fabrics, plain or twilled, printed or manufactured of dyed yarn—	
Weighing more than 120 grams per square meter and having per 6 millimeters square—	
Not more than 20 threads.....	.175
From 21 to 30 threads.....	.285
Weighing from 80 to 120 grams, inclusive, per square meter and having per 6 millimeters square—	
Not more than 20 threads.....	.285
From 21 to 30 threads.....	.35
Fabrics, figured in the loom, weighing per square meter:	
More than 300 grams.....	.35
From 201 to 300 grams.....	.438
From 151 to 200 grams.....	.525
Not more than 150 grams.....	.744
Fabrics, quilted, with raised nap, and the like, including blankets and Turkish towels.....	.35
Velveteens and other plush fabrics, except carpets.....	.306
Carpets.....	.154
Fabrics prepared for copying designs and for bookbinding.....	.175
Common fabrics, stiffened with gum for linings and frames of hats.....	.088
Tulles:	
Plain.....	.438
Figured, including crochet tissues and lace of all kinds.....	.547
Fabrics, knitted and netted:	
Corset covers, undershirts, and drawers, sewn or not.....	.429
In any other form, including lamp mantles.....	.613
Trimmings and ribbons, not more than 5 centimeters wide.....	.263
Wicks for lamps and candles.....	.088
Hunting and fishing nets, and hammocks of cotton net.....	.105

¹ Per 100 pounds.

AMERICAN TRADE.

American cotton goods are practically unknown in Spain. High duties, freight rates, and distance make it almost impossible for the United States to compete with the native mills and those of near-by nations. I showed a full line of American goods to an importer in Barcelona and compared them with similar goods of domestic manufacture. The prices of the latter are about 10 per

cent higher than the former, but the tariff, which amounts to over 30 per cent ad valorem, precludes the possibility of exporting American cotton goods to Spain.

At the time this report is written (July, 1911) there is a strong movement on foot to secure the temporary free entry of certain lines of cotton goods, particularly print cloths. A commission has been appointed by the interested persons to study the question and present the matter to the Cortes at its next session. The purpose of this movement is to make it possible to import cotton goods into Spain, where they may be printed and exported. One of the leading importers stated that if this measure should succeed there would undoubtedly be a market for American sheetings, print cloths, and flannels, all of which he stated, after examining the samples, were superior in quality to the domestic product.

The interests of the United States in all lines are greatly handicapped, however, by lack of proper representation. There are no large independent importers in Spain who buy goods in the best market, the principal houses being merely distributing branches of European manufacturers, through whom it is useless to attempt to sell goods, as they are "tied up" with other manufacturers. Orders must come, therefore, from dealers who style themselves wholesalers and retailers, but who purchase in comparatively small quantities.

TERMS OF CREDIT—TRADE METHODS.

No systematic effort has been made to reach the trade and it is generally through accident alone that these dealers learn of any article of American manufacture that they want. Unfortunately there is a widespread belief in the United States that business can not be conducted with Spain on a safe basis. This is probably due to the fact that credit has frequently been given to unreliable parties, and the houses that have suffered losses have felt compelled to make all sales on a strictly cash basis. The result has been that responsible houses have been quoted such harsh terms that they refuse to consider further importations. Business in Spain can be conducted on as safe a basis as anywhere else, but like every other business it involves the exercise of ordinary common sense and judgment.

Spain's purchasing power is not very large and the volume of the trade in any one line is not sufficiently important to justify special representation. It would be easy, however, to canvass the trade from some European center. In order to secure business it is highly important that catalogues and circulars be printed in the Spanish language and that prices be quoted (in Spanish currency) c. i. f. some port of the country. Catalogues, valuable as they are, can not secure the trade from nations who have personal representatives in the country. There is a marked dearth of American commercial travelers in Spain, and without their active aid manufacturers can not hope for a large volume of business. Advertising on the large scale on which it is conducted in America is almost unknown in Spain. Undoubtedly many American products would find a ready sale in the country if an aggressive campaign of advertising, supported by travelers familiar with the language, were inaugurated.

COTTON MANUFACTURING.

Although, as has been shown, Spain offers little as a market for American cottons, a study of the Spanish export trade should be of value to manufacturers in the United States, for not only does Spain ship large orders to the Philippines, Cuba, and Porto Rico, but its goods come into competition with those from the United States, particularly in Central and South America and in the Levant.

One striking example is the case of Argentina. Spain shipped to that country in 1900 cotton goods to the value of \$60,993 (Argentine statistics), and in 1908 the importations from Spain had risen to \$663,266, an increase of 987.12 per cent, a more favorable showing than that of any other competing nation. In the latter year the imports of dyed and printed piece goods from Spain amounted to \$342,996, while the United States furnished the insignificant amount of \$5,184 of this class of textiles.

The increase in Spain's sales of cotton goods to Argentina is shown in the following table, compiled from Spanish statistics:

Articles.	1906	1909
	<i>Pounds.</i>	<i>Pounds.</i>
Yarn.....	90,375	98,519
White goods.....	135,298	226,137
Dyed and printed goods.....	1,405,259	2,863,065
Knit goods.....	67,500	99,017
Total.....	1,698,432	3,286,738

These figures clearly indicate that the importance of Spain in the manufacture of cotton goods is greater than is generally known. The growth of the export trade will be discussed later at length; enough has been said to indicate that an account of the rise and progress of the textile industry in Spain and its present status should be of interest to American cotton manufacturers.

CENTRALIZATION OF INDUSTRY.

The heart of the industrial life of Spain is in the district of Catalonia, which is formed by the four Provinces of Barcelona, Gerona, Tarragona, and Lerida, embracing an area of 12,000 square miles and containing a population of less than 2,000,000 people. In other parts of Spain manufactured articles are bought abroad and agricultural products are sold, but in Catalonia the contrary is true. Sugar, cork, paper, shoe, metallurgy, machinery, wine, and olive-oil industries are established in the district and have been successfully operated for a number of years. The reason for this is not only the natural and climatic advantages of the district, but also the superior enterprise and energy of the Catalans. Barcelona, the thriving capital of Catalonia, is the largest port in Spain and the fourth cotton port in Europe, ranking after Liverpool, Bremen, and Havre. Its harbor has a surface of more than 350 acres, and one-fourth of the total trade of Spain enters this port.

The centralization of cotton manufacturing in Catalonia is particularly marked; the district occupies the same position in Spain as Lancashire holds in England, more than 90 per cent of the total cotton spindles in Spain being located in Catalonia.

The Catalans have been called the "Dutch of Spain" on account of their enterprise and progressiveness, and their business acumen combined with the geographical advantages of their district has enabled them to keep in the van of progress. The largest and oldest industry in Catalonia is the textile industry, cotton ranking first, followed by the woolen, linen, silk, hemp, and jute. Barcelona is at once the Liverpool and the Manchester of Spain.

EARLY HISTORY OF COTTON MANUFACTURING.

The cotton industry was established many centuries ago in Catalonia. In the twelfth and thirteenth centuries there was in existence in Barcelona a guild of cotton manufacturers called "Gremio de los Fustaneros," fustanes then being the general term for all cotton cloth. The products at that time were principally trouserings, velvet and plush, and the industry was carried on not only in the capital but also in various villages of the old principality, especially in the district of Llobregat. In the eighteenth century calico printing developed, due to the facilities of importing gray cloth from abroad, principally India. The great extension in cotton cultivation and the invention of High's spinning machine determined the predominance of the cotton industry in Spain.

As early as 1780 a "Yarn Society" was formed in Barcelona, which was really the predecessor of the present Fomento del Trabajo Nacional, an association which to-day occupies a very important place in the industrial life of Spain. The society was afterwards called the Royal Company of Cotton Manufacturers, with three departments, those of spinning, weaving, and printing. One of the first questions this association took up was that of the supply of raw material. The Government of Carlos III energetically assisted in obtaining from year to year a larger supply. The crops in Spain and the Canary Islands were almost insignificant (181,000 pounds), but as a result of efforts in Mexico, Venezuela, Cuba, and Porto Rico more than 2,500,000 pounds were received from those countries in 1798.

The war with France in the early part of the nineteenth century retarded the progress of the industry, but it also served to free it from French influence, and from 1820 to 1850 there was a marked increase in the number of spindles. In the former year there were 7,000 spindles in operation, consuming 2,000 bales (500 pounds each) of raw material. In 1850 the spindles had increased to over 500,000 and the consumption of cotton to 66,000 bales.

PROGRESS IN RECENT YEARS AS REVEALED BY TRADE STATISTICS.

The following table, compiled from figures furnished by the Fomento del Trabajo Nacional, shows clearly the progress of the industry in the years 1885 to 1910:

Years.	Imports of raw cotton.	Exports of cotton cloth.
	<i>Bales.</i>	<i>Metric tons.</i>
1885.....	190,286	2,280
1890.....	202,617	5,460
1895.....	289,139	8,500
1897.....	282,579	11,587
1906.....	328,518	7,663
1910.....	301,210	9,357

The imports of cotton goods at the port of Barcelona during the years 1897-1910 were as follows:

Years.	Yarn.	Fabrics.	Years.	Yarn.	Fabrics.
	<i>Pounds.</i>	<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>
1897.....	496,990	283,095	1904.....	326,984	482,955
1898.....	326,352	181,432	1905.....	354,672	477,047
1899.....	532,368	241,734	1906.....	323,196	430,854
1900.....	487,697	349,308	1907.....	218,868	565,136
1901.....	424,943	348,580	1908.....	179,260	492,428
1902.....	523,163	448,023	1909.....	166,562	533,870
1903.....	463,387	394,473	1910.....	145,768	637,310

The decrease in the imports of yarn during the period strikingly exhibits the progress of the industry. The yarns now imported are colored ply yarns, special numbers or high counts, and England supplies the largest proportion, followed closely by Germany.

In cloth imports the figures show fluctuations, with an increase in recent years. This appears to be caused, as has been stated, by a demand among the wealthier classes for the finer grades, which the native mills have not yet found it profitable to manufacture.

COTTON MILLS.

There are to-day in Spain over 600 cotton mills, with a total capital of 200,000,000 pesetas (\$35,840,000)¹ and operating 1,800,000 spindles and 60,000 looms. The number of operatives is estimated at 100,000, and the total value of all the plants, estimated at 110 pesetas per spindle, is 198,000,000 pesetas (\$35,481,600). More than 300,000 bales of raw cotton are annually transformed into manufactured goods, valued at over 450,000,000 pesetas (\$80,640,000). No detailed statistics of the cotton industry in Spain are published; the foregoing figures were furnished by the president of the Spanish Cotton Manufacturers' Association, the best informed man in the country and one who has made a close study of the subject, and they have been confirmed by other authorities.

Although Barcelona is the center of the industry, many mills are situated in neighboring towns and in the surrounding country, along the coast, and in the valleys of the Rivers Ter, Frezer, Llobregat, and Cordoner. The towns of Sabadell, Granollers, Manresa, Vilasar, Villanueva, Mataro, and Badalona, all within 20 miles of Barcelona, are important centers of the textile industry. A number of the mills, however, are located in so-called "colonias," or mill villages, away from the railroad.

The industry is modeled after that of the United States, spinning, weaving, and finishing being carried on in each mill. In addition, many of the plants maintain complete bleaching and printing departments, which enable them to furnish the finished product to the trade. There are also numerous separate spinning mills and printing establishments.

Spain is proverbially a country of small enterprises, and this is evidenced by the number of small mills. The largest cotton factory contains only 50,000 spindles, and the average is less than 15,000.

¹ In the conversion of Spanish to American currency in this report the peseta, which fluctuates in value, has been taken as equivalent to \$0.1792.

The average number of yarn is 30, although yarn up to No. 100 is spun in a few mills for the manufacture of fine goods from Egyptian cotton. The average annual production is 30 kilos (66.13 pounds) per spindle from Egyptian and 40 kilos (88.18 pounds) from American.

As is the case with many other enterprises in the country, incorporated companies are unknown in the cotton industry. Practically all the mills are owned by private companies, usually composed of one or two families. One frequently finds them operating under the name of "The Widow of —," "The Brothers of —," "The Nephews of —," etc. The nature of the organization makes it difficult, if not impossible, to ascertain the profits. During 1909 the mills shared in the world-wide depression and curtailment of over 10 per cent in production was general. During 1910, however, there was some improvement in trade, and practically all the mills are now running full time and about three-fourths of them are working day and night.

SOURCES OF RAW MATERIAL.

The mills depend on the United States for about three-fourths of their raw material. The number of bales imported from the various countries in the past 10 years, the percentage furnished by the United States, and the average price of the American cotton on the New York market are given in the following table:

Years.	United States.	India.	Egypt.	Other Asia.	Brazil.	All other countries.	Per cent American.	Average price of American.
	<i>Bales.</i>	<i>Bales.</i>	<i>Bales.</i>	<i>Bales.</i>	<i>Bales.</i>	<i>Bales.</i>		<i>Cents.</i>
1901.....	243,536	26,305	29,282	7,225	.....	6,291	73.2	8.96
1902.....	267,647	21,295	29,614	11,965	.....	10,374	81.4	8.75
1903.....	247,180	58,456	25,983	10,725	1,761	15,025	68.8	10.27
1904.....	169,999	63,298	24,795	8,401	2,104	8,022	61.4	12.58
1905.....	287,809	22,926	23,023	5,765	.....	3,784	83.8	9.13
1906.....	239,033	46,065	21,224	10,971	.....	6,132	72.7	11.20
1907.....	290,626	62,279	19,072	13,553	5,073	9,968	71.9	11.48
1908.....	254,318	55,075	22,153	16,804	3,173	10,608	70.7	11.28
1909.....	233,051	44,558	18,804	10,680	.....	7,493	78.2	10.42
1910.....	185,280	79,481	15,874	9,792	112	10,783	61.5	14.97

The amount given under "all other countries" includes chiefly cotton from Turkey and Peru. It will be noticed that when the price of American cotton was high the Spanish manufacturers purchased an increased amount from India. At present large quantities of Indian cotton are being imported and mixed with the American, in the proportion of 25 to 75, in the manufacture of sheetings, and even more Indian is used in the production of coarse goods. This, coupled with cheaper labor, enables the Spanish manufacturers to produce an article that can undersell the American in markets where cheapness and not quality is the main consideration.

PRICES OF COTTON—BARCELONA EXCHANGE—COTTON GROWING.

The present (July 5, 1911) price of the three classes of cottons, American, Egyptian, and Indian, c. i. f. Barcelona, is as follows per pound: American good middling, 17.88 cents; Egyptian, 20.61 cents; Indian Bengal, 14.45 cents; Indian Brooch, 14.72 cents. On the same day American good middling was quoted at 7.99 d., or 15.98 cents, in Liverpool; the same cotton would be graded as strict middling in New York, where it was quoted at 15.07 cents.

On July 7 the Barcelona Cotton Exchange was inaugurated. The transactions were for futures, Liverpool classification, and for lots of 25 bales. Quotations opened at \$37.30 per 100 kilos (220 pounds), rising to \$37.60, and closing at \$37.55. Seven hundred bales were sold for the end of November. In the afternoon session 1,500 bales were sold and quotations closed at \$37.60 per 100 kilos. The result of these opening transactions as regards sales was considered satisfactory.

Attempts to grow cotton in Spain have not proved successful. During the Arab occupation cotton was cultivated in the fertile plains of Granada, Seville, Cadiz, and Valencia, and in more recent times experiments and studies have been made periodically, but with little result. The soil and the climate are favorable, but the fact that the farms are divided into small tracts, the lack of irrigation, and the fact that other crops are more remunerative to the planter have hindered cotton cultivation.

An organized effort is now being made to raise cotton in the African colonies of Spain (Rio de Oro and Spanish Guinea). The climate, soil, temperature, and moisture of the country are all that could be desired, and the topography of the land makes it possible to use the latest agricultural machinery in the planting and harvesting of the crop.

SPANISH AND AMERICAN YARNS.

The system of numbering yarns in Spain differs slightly from the English method. In the latter, one skein, or hank, of 840 yards of No. 1 yarn weighs 453 grams, whereas in the Spanish system 850.28 yards (777.5 meters) of No. 1 yarn weigh 550 grams. To reduce the Spanish number to the corresponding English number the formula $E = 0.96154 \times S$ may be used, E being the English number and S the Spanish number.

For the purchase and sale of yarn there is organized in the Fomento del Trabajo Nacional a cotton-yarn exchange, which controls the form and execution of contracts and arbitrates disputes. Most of the spinners and weavers in Catalonia are members of this association.

The present (June, 1911) prices of Spanish yarns in Barcelona and the prices of the nearest equivalent American yarns follow:

Spanish numbers.	Price per pound.	American numbers.	Price per pound.
AMERICAN COTTON.		AMERICAN COTTON.	
	<i>Cents.</i>		<i>Cents.</i>
14/1	23.14	14/1	22.50
18/1	24.06	18/1	23.00
22/1	25.00	24/1	25.00
26/1	25.91	28/1	25.50
30/1	26.84	30/1	26.00
24/2	27.30	24/2	25.00
30/2	30.08	26/2	25.50
40/2	32.40	30/2	26.50
EGYPTIAN COTTON.		EGYPTIAN COTTON.	
30/1	32.40	31/1	36.00
40/1	35.16	40/1	41.00
60/1	41.65	60/1	54.00
30/2	35.16	30/2	38.00
60/2	38.80	60/2	55.00
80/2	63.85	80/2	72.00

Quotations of yarns are made in reals (4.48 cents) per 4.4 kilos (9.7 pounds), discount of 2 per cent for cash. For example, No. 14/1 warp yarn is quoted at 50 reals (\$2.24) per 4.4 kilos. Yarns made from American cotton are quoted higher than in the United States, but those made of Egyptian yarns are considerably lower. Yarn is sold at four months net, in addition to the month during which delivery is made, or 2 per cent discount if settlement is made in 30 days. Raw cotton is sold at 60 days net. If payment is made before, discount is at the rate of 5 per cent annually; if paid after 60 days, interest is charged at the same rate. Cloth is sold on four months' time or 2 per cent in 30 days.

KINDS AND COST OF POWER.

Spain contains a large number of waterfalls supplying comparatively cheap power. It has been estimated that over 5,000,000 horsepower can be developed from the rivers of the country, of which only 80,000 is now utilized. Of the 1,800,000 spindles in Spain, more than 1,200,000 are in mills situated on or near rivers. About three-fourths of the spindles use water as a motive power, with steam or electric auxiliary installations for use when the rivers are low.

The system under which power is purchased is unique. The owner of the water power usually owns the mill building, and for the rent of the building and the use of the power day and night an annual charge of 100 pesetas (\$17.92) per horsepower is made. The contract is usually made for 10 years, with the privilege of renewal. The use of water to develop electric power is not extensive, owing to the lack of large enterprises and the difficulty of securing capital with which to prosecute big undertakings. Attention has lately been drawn to the possibilities along this line and the indications are that considerable progress will be made in the near future.

Steam power, which is used altogether in the city of Barcelona, costs 125 pesetas (\$22.40) per horsepower, while the cost of electric power developed by steam is 250 pesetas (\$44.80) for day and night run. These figures were furnished by the president of the Spanish Cotton Manufacturers' Association, and are interesting because they reveal the fact that the cost of power is much lower in Spain than in the United States. Most of the coal used by the cotton mills is from Asturias, in Spain, and is sold at 31 pesetas (\$5.55) per ton. It possesses 7,000 calories. The price of imported coal is higher, being \$7.20 per ton for the Cardiff and \$5.76 for Newcastle, on carts at quay in Barcelona.

TYPE OF MILL CONSTRUCTION.

The current type of construction consists of a ground and a first floor built of stone or concrete, but some factories, particularly in the large towns where building sites are more expensive, have three or four stories. In the more modern mills ventilation and light are good, but the contrary is true of many of the older ones. Humidifying systems are not generally used, but in most of the factories visited the work seemed to be running well, although, as in most European countries, more operatives are required per machine than in the United States.

There are no automatic sprinklers in the mills, although patent fire extinguishers are very generally used. The reasons for this lack of fire protection, I was told, are the infrequency of fires and the greater facility in combating them, owing to the fact that many factories work day and night, and that there are generally fewer floors in one building than in other countries. Another and very important reason for the failure to install sprinklers is the low insurance rate now in force, which varies between 2 and 5 pesetas on the thousand, and the insurance companies offer a reduction of only 25 per cent in the case of mills with sprinklers. As the estimated cost of the installation is 1.50 pesetas (\$0.2688) per spindle, the manufacturers are not inclined to favor the proposition. In the last few years there have been 251 fires in the cotton mills, and the aggregate loss amounted to 860,040 pesetas (\$154,110). The total annual premiums paid by the mills is given as 594,000 pesetas (\$106,445).

COST OF MACHINERY.

More than 80 per cent of the cotton-mill machinery in use is of English make, Platt Bros., Howard & Bullough, Brooks & Doxey, Heatherington, and Dobson & Barlow being the chief firms represented. Following are the prices (c. i. f. Barcelona) of the principal machines used:

Machines.	Price.	Machines.	Price.
Opener and automatic feeder.....	\$866	Dry ring doubler, 200 spindles.....	\$793
Intermediate scutcher.....	662	40-bank cop reel.....	39
Finisher scutcher.....	818	Pin winder, 56 spindles.....	224
40-inch revolving flat card, 106 flats.....	496	Warp winder, 20 drums.....	166
Drawing frame.....	1,110	Winding frame, 240 spindles.....	788
Stubber, 88 spindles.....	905	Warping frame, 52 r. s. looms.....	253
Intermediate frame, 136 spindles.....	1,148	Slasher sizing machine, 52 looms.....	1,518
Roving frame, 176 spindles.....	1,124	Slasher sizing machine, 40 inch (Spanish).....	72
Jack frame, 232 spindles.....	1,445	16-shaft dobby loom, 43-inch reed space.....	165
Warp ring frame, 400 spindles.....	1,651	Jacquard loom, 72-inch reed space.....	182
Wet ring frame, 420 spindles.....	1,106		

These are the prices on the very best English machinery, given me by the representative of the manufacturers, and are for machines for a mill running on 20s to 30s yarns. Other makes can be bought at a somewhat lower figure. It should be stated that practically all the plain looms are now made in Spain, the imports of this class of machinery being small. The duty on all machinery is levied by weight, and the proportionate cost is very high in the case of a plain loom. Dobby and Jacquards, although heavier than the plain looms, are much more valuable, so that the customs duty is small as compared with the cost of the loom, hence they are usually bought abroad, although a few are now made in the country. The looms made in Spain are modeled after the English type, in many cases being almost identically the same. Attempts have been made to manufacture other kinds of cotton-mill machinery, particularly spinning frames, but without apparent success.

AUTOMATIC LOOMS.

The use of automatic looms is not large, about 700 of the Northrop pattern being operated in the entire country. There are several reasons for this. In the first place, the mills in Spain do not special-

ize, many classes of cloths being made in each factory, and the Northrop pattern is not adapted to the weaving of many varieties. Again, one of the chief claims made for the Northrop loom is the great saving in labor, but owing to the cheapness of labor in Spain this argument does not appeal to the cotton manufacturers sufficiently to induce them to pay the higher price charged for the loom—1,400 pesetas (\$251) in Barcelona. Finally, the dull times through which the industry has been passing have retarded the expenditure of money on improved machinery.

Recently a new type of automatic loom has been introduced in Spain, and about 200 of them are now in operation. This loom is of Alsatian manufacture, and like the Northrup pattern it is a bobbin-changing loom. The principal point in which it differs from the latter is that the bobbins of yarn are placed in a long bar or cartridge, which extends over the loom, rather than in a round cylindrical battery. There are three of these, one in action and two in reserve, and it is claimed that they hold sufficient weft to run the loom one day of 10 hours, thus eliminating the necessity of continually recharging the battery. This loom is run at a higher speed than the Northrop, and the cloth woven on the one I saw in operation was of excellent quality and lacking in defects, such as unevenness, mispicks, and thin places. The price of the loom at the works in Alsace is 970 francs (\$187.20) and the price in Barcelona is \$221.55. Of Jacquard looms there are about 4,000 in Spain.

As already stated, the mill buildings in Spain are generally rented. The cost of spinning machinery with all the preparatory machines (lappers, cards, drawing, and roving) is approximately 40 pesetas (\$7.17) per spindle, and weaving complete (20s to 30s yarn, plain white goods) 60 pesetas (\$10.75) per spindle. These figures, however, do not include the power plant.

SPINNING AND WEAVING PROCESSES.

There are three characteristics of the cotton industry that impress the American upon entering a Spanish cotton mill: First, the large number of operatives required; second, the predominance of female employees (only about 15 per cent are males); third, the wide range of fabrics produced in each factory. There are a number of mills, for instance, making plain sheetings, colored goods, oxfords, prints, colored drillings, and, in the same establishment, gros de Tours or bedspreads, and other Jacquard fabrics. As the mills are all small as regards individual units, this method necessitates many details in management, separate mixings of cottons, and the production of a wide range of yarns.

In the opening room 10 to 15 bales of cotton are usually mixed at once. The scutchers, or lappers, are situated in a separate room, as is the custom in the United States. They are of the usual English type, but some of the more modern machines are equipped with the latest improved double automatic feeder, and the cotton is delivered direct to the hopper by the blower system through a large pipe leading from the opening room. The cards are mainly of the revolving flat construction, 40 inches wide, with 106 flats. A number of the old-style stationary flat-top cards are still being operated, often by the side of the improved type, but the former are gradually

being eliminated. Both two and three processes of drawing are used.

The spinning frames are all on the English style, having one leather-covered front roller, and uncovered self-weighted middle and back rollers. Both the weaving and spinning frames have many more spindles than the American type, 420 being the average number of spindles on the latter. The speed of the spindles on No. 20 yarn is about 9,000 revolutions per minute. Seventy-five per cent of the looms are of the overpick type, and the average speed of the 40-inch looms is 190, 160, and 150 for the plain, Northrop, and Jacquard types, respectively.

SOURCE OF MILL SUPPLIES.

Practically all supplies used in the mills are made in Spain. There are firms in and around Barcelona manufacturing belting, pickers, picker sticks, bobbins, spools, shuttles, harness, reeds, fiber cans, pulleys; in fact, practically all the supplies required by the mills. The low prices prevailing for all these lines, together with the protection afforded by the customs duties, make it impossible for foreign supply houses to secure any of the trade.

Picker sticks, similar to the kind used in the United States on the plain loom, made from the best quality of Spanish oak, are sold for about \$30 per thousand, whereas the same article in the United States costs nearly \$50. Shuttles for 5 and 6 inch bobbins are quoted at about \$3 per dozen, while the corresponding price in the United States is \$6. The importation of paper bobbins and tubes, however, is considerable, as the mills seem to prefer the foreign product on account of the difference in quality. Most of these are imported from Germany. [A sample of the 6-inch paper bobbin, which is used both by the complete spinning and weaving mills and by the spinning mills only is filed in the Bureau of Manufactures.] Yarn for the market is usually placed on these bobbins and sent to the customer, the empty bobbins being returned to the mill. The price of the 6-inch paper bobbins f. o. b. the factory is 5.70 francs (\$1.10) per hundred, and duties and charges are nearly 100 per cent.

The price of the fiber spools of the kind generally used, 150 by 115 millimeters (5.91 by 4.53 inches), is \$4.85 per hundred, exclusive of duty and freight. The 5-inch wooden bobbins made in Spain are considerably cheaper than those of paper, the price being 22 cents per gross for a 7-inch warp bobbin.

Hand-threading shuttles are practically unknown, and I did not find a single mill using knot tiers.

WAGES OF OPERATIVES.

Wages paid in the Spanish cotton mills are considerably lower than those prevailing in the United States, ranging from 8 pesetas (\$1.43) per week, paid to doffers, to 28 pesetas (\$5.02), paid to the most skillful weavers. The average wage is about 20 pesetas (\$3.58) per week. Attention has already been drawn to the fact, however, that the operatives are less efficient than American workers and do not tend so many machines. In talking with one of the leading cotton manufacturers I stated that in American mills spinners tend 10 sides

and weavers 8 looms on plain goods. He smiled and said that such a thing was impossible in Spain, the number to each operative being 2 sides of spinning and 2 to 4 looms. Wages are paid partly by the piece and partly by the day, the latter system being most generally used.

Following are the average wages paid in the different departments:

Class of work.	Weekly wages.	
	Spanish currency.	American currency.
	<i>Pesetas.</i>	
Leppers, 1 machine per man.....	18 to 20	\$3.22 to \$3.58
Cards, 8 to 10 cards per man.....	18 to 20	3.22 to 3.58
Drawing frames, all women, 8 heads per operative.....	14 to 16	2.50 to 2.86
Roving frames, all women, 1 frame per operative.....	14 to 16	2.50 to 2.86
Spinning frames, men and women, 1 frame per operative.....	16 to 20	2.86 to 3.58
Doffers, 2 frames per girl.....	8 to 9	1.43 to 1.61
Spoolers and warpers, usually men.....	18 to 20	3.22 to 3.58
Weavers, men and women, 2 to 4 looms per operative.....	18 to 25	3.22 to 4.48
Cloth and finishing room, men and women.....	16 to 22	2.86 to 3.94
Miscellaneous labor.....	18 to 20	3.22 to 3.58

The wages for night work are slightly higher than those given in the table. A movement is on foot to prohibit women from working at night, and this will probably have the effect of increasing the cost of production.

Weavers run two looms, both on plain and on colored fancy goods. Northrop weavers tend eight looms and earn 25 pesetas (\$4.48) per week. The variation in wages, as shown in the foregoing table, depends on the location of the mill, the highest being paid in Barcelona and the lowest in the colonias, or mill villages.

The hours of work are 66 per week for the day and 48 for the night run. Three-fourths of the cotton mills in Spain are now being operated night and day.

WEEKLY COST OF OPERATING WEAVING MILL.

The weekly cost of operating a weaving mill of 400 looms making plain white goods 33 inches wide, 96 by 96 picks per inch, weighing 4 yards to the pound, is as follows (figures of the Fomento del Trabajo Nacional):

Employees.	Weekly wages.	Employees.	Weekly wages.
Superintendent.....	\$13.00	2 measurers, at \$3.10 per week.....	\$6.20
2 clerks, at \$4.32 per week.....	8.64	1 fireman.....	5.20
8 overseers, at \$5.20 per week.....	41.60	1 fireman's assistant.....	3.46
1 timekeeper.....	6.05	1 engineer.....	6.92
2 assistants, at \$3.80 per week.....	7.60	1 electrician.....	6.92
4 warpers, at \$2.75 per week.....	11.00	2 machinists, at \$4.32 per week.....	8.64
14 threaders, at \$2.75 per week.....	38.50	4 carpenters and miscellaneous laborers, at \$4.32 per week.....	17.28
4 skelners, at \$2.75 per week.....	11.00	2 apprentices, at \$1.36 per week.....	2.76
5 knotters, at \$2.75 per week.....	13.75	1 laborer.....	3.10
4 porters and messengers, at \$3.10 per week.....	12.40		
200 weavers, at \$3.46 per week.....	692.00	Total.....	927.70
4 cleaners, at \$2.92 per week.....	11.68		

The annual production of the class of goods stated averages 60 pieces of 78 yards each per loom.

PRODUCTION OF KNIT GOODS.

The manufacture of knit goods, which is carried on throughout Catalonia, and especially in the small town of Mataro, is developed to a high state of efficiency. The annual production of over 20,000,000 pounds is shipped all over Spain, to the Philippines, and to South America. These mills purchase their yarn from the local spinners on liberal credit terms, and with the aid of improved machinery (mostly German) and cheap labor they are able to compete successfully in the world's markets for cotton knit goods, while the tariff of 4.90 pesetas per kilo (\$0.429 per pound) on the principal lines of knitted goods protects them in the home market.

Practically all the labor employed consists of girls and women, who earn from 3.50 to 5 pesetas (63 to 90 cents) per day.

Underwear, hosiery, and caps are manufactured, but few sweaters and fancy articles are produced. One line of cheap cotton socks sells at 40 to 61 cents per dozen pairs, while the price of another ranges from 26 to 40 cents. The largest demand for knit shirts is for the cheap qualities, ranging in price from \$2.25 to \$3.24 per dozen. [Samples of these socks and shirts are filed in the Bureau of Manufactures.]

LIVING CONDITIONS OF MILL WORKERS.

The Catalan is noted for being a sober and industrious worker, and his steadiness and regularity have contributed in no small measure to the success of the cotton industry. This is true notwithstanding the fact that over 32 holidays, or fiestas, are observed in Spain, on which all the mills close. The condition of the cotton-mill operatives is no worse than that of the average working people in Spain, but the standard of living is below that of the employees in American cotton mills.

Eleven hours constitute a working-day according to law, but several of the mills that I visited were running 12 hours. Work usually begins at 5.30 a. m. and ends at 6.30 p. m., with a half-hour stop at 8 a. m. for breakfast and an hour and a half at noon for lunch. The law provides that children under 10 can not be employed, and those from 10 to 14 years old may work only 6 hours per day, but the regulation is not strictly observed. The condition of the working class in Spain has greatly improved in recent years.

Several years ago the mills suffered from numerous strikes among the employees, owing to a policy of retrenchment in both hours and wages due to the dull state of business. In recent times, however, there has been no trouble between manufacturers and laborers.

Organization among the cotton-mill employees finds its highest expression in the cooperative societies, which are numerous. Through them the laborers obtain at a lower price, and sometimes of a better quality, food products and other necessities. These societies, some of which are open to the public, make small annual profits, which are either distributed among the members or applied to some useful undertaking, such as the maintenance of a school or a church.

The dwellings in which the operatives live are old and insanitary, and the conditions as regards hygiene and health are not very good. The houses are built of plastered brick or stone, and consist of two,

three, or four rooms. The rents are very low, ranging from 4 to 10 pesetas (\$0.72 to \$1.79) per month. The chief articles of food consumed by the laboring class are fish and vegetables (beans, lentils, potatoes, lettuce, and artichokes). Meat, other than fish, is seldom, used by the workers.

PRICES OF FOODSTUFFS AND FUEL.

The prices in Barcelona of foodstuffs and fuel in June, 1911, were as follows (kilo = 2.2046 pounds; libra = 1.0144 pounds avoirdupois):

Articles.	Price.	Articles.	Price.
Artichokes.....dozen..	\$0.072	Garlic.....dozen..	\$0.054
Beef.....libra..	.18	Ham.....libra..	.54
Bacon.....kilo..	.315	Lard.....do..	.15
Bread.....do..	.08	Lettuce.....piece..	.01
Butter.....libra..	\$0.36 to .45	Milk.....quart..	.10
Cabbage.....piece..	.02	Onions.....libra..	.02
Cheese.....libra..	.10 to .24	Potatoes.....3 pounds..	\$0.29 to .58
Coal.....25 pounds..	.315	Sausages.....libra..	.05
Coffee.....libra..	.45 to .54	Spinach.....do..	.04
Eggs.....dozen..	.225 to .25	Sugar.....do..	.09
Fish:		Tomatoes.....kilo..	.16
Codfish.....libra..	.135	Wheat flour.....libra..	.055
Tunny fish.....do..	.108	Wine, common.....quart..	.05 to .10
Eel.....do..	.18	Wood:	
Flounder.....do..	.18	Fire.....88 pounds..	.45
Sardines.....do..	.072	Kindling.....12 bundles..	.05

ORGANIZATION OF MANUFACTURERS.

The Spanish Cotton Manufacturers' Association was formed a number of years ago and includes practically all the mills in the country. It is allied with the International Association of Master Spinners and Cotton Manufacturers' Associations, which held its annual congress in Barcelona in May, 1911. The organization is active and alive to the interests of the industry, and through it cooperation is secured in all matters pertaining to improvements in manufacturing and to the extension of trade in cotton fabrics.

The manufacturers are also closely allied with the Fomento del Trabajo Nacional in Barcelona, which has already been mentioned. This is the most important economic association in Spain, and it embraces practically all the important industries in Catalonia. There are four sections devoted, respectively, to agriculture, industry, commerce, and science and fine arts. The association takes an active part in all questions pertaining to Spain's progress along agricultural, industrial, and commercial lines, and fosters and assists in organization in all lines of trade. It is a source of information, and through meetings, lectures, and publications participates in all efforts to advance the country's interests and develop its resources; it is particularly active in tariff matters.

PROFITS IN THE INDUSTRY.

As the cotton mills in Spain are not incorporated, but are organized on a private basis, no accurate returns of profits are made. In an interview a very prominent manufacturer stated that the average profit of all the mills in Spain is about 10 per cent, out of which, however, the salary of the proprietor is paid. The manager of a large

credit agency informed me that the financial standing of the cotton mills is excellent and the credit rating of the majority of them is high.

Yarns are usually sold through brokers, who charge 1 per cent. Prices, as already stated, are usually fixed by the yarn bourse. In case of disagreement between buyer and seller the points in dispute are settled by arbitrators chosen by the parties interested, and, when necessary, all documents and books pertaining to the case must be submitted for examination.

Sales of cloth are effected directly by the mills and through brokers, who charge one-half of 1 per cent commission. All the more important mills maintain offices and large warehouses in Barcelona from which sales and deliveries are made. The manufacturers of course find their best market in Spain itself, which purchases about 80 per cent of the annual production of the mills, valued at \$80,640,000.

LIST OF PRINCIPAL MILLS.

Following is a list of the most important mills in Spain, with the number of spindles and looms in each:

Firms.	Spindles.	Looms.	Firms.	Spindles.	Looms.
M. Bertrand é Hijo.....	20,000	800	La España Industrial.....	23,000	1,200
Sucessores de B. Brutau.....	21,000	250	Viuda de J. Tolrá.....	20,000	600
Hijos de B. Reolons (spinning only).....	50,000	.....	Juan Bertrand.....	20,000	500
Hilaturas de Fabra y Coats (spinning only).....	50,000	.....	Ignacio Abadal.....	20,000	400
J. Poch.....	11,000	300	Rosá Hermanos.....	20,000	400
La Industria Malagueña.....	38,000	1,600	Luis Pons y Sobrinos.....	20,000	400
Sobrinos de Juan Batlló.....	31,000	600	Sucessores de Pedro M. Calvet.....	15,000	300
L. A. Sedó.....	20,000	1,200	Riva y García.....	15,000	300
Güell y Cia.....	24,000	600	Rosé y Cia.....	14,000	100
Viuda é Hijos de Fco. Burés.....	30,000	800	Estabanell y Fahná.....	15,000	400
			La Algodonera Guipuzcoana.....	12,000	150
			Juan Vial.....	9,000	450

All of the mills listed are in the Province of Barcelona, with the exception of La Industria Malagueña, which is in Malaga, and La Algodonera Guipuzcoana, in the Basque Province of Guipuzcoa.

FACTORY OF L. A. SEDÓ.

The mill of L. A. Sedó, Sociedad en Comandita, is one of the most important in Spain, although there are other factories containing more spindles. It was founded in 1860 and is situated in the "colonia" Sedó, about 20 miles from Barcelona. The capital of the mill is 8,000,000 pesetas (\$1,433,600). Thirty thousand spindles and 1,200 looms are operated night and day, the total number of employees being 2,000. The mill is situated on the River Llobregat, from which 4,500 horsepower is developed through water turbines and electric generators, at a cost of about \$30 per horsepower per year for a night and day run. Only 1,500 horsepower is utilized by the mill, however, the remainder being used in a factory for the production of calcium carbide. Part of the latter is used for the lighting system in the mill, but large quantities are made for the market.

Twelve thousand bales of cotton are annually transformed by this mill into 15,000,000 meters of cloth. The product is chiefly velvets

and corduroys, large quantities of which are exported to South America. The mill has its own finishing plant, in which the cloth is dyed in the piece and finished for the trade. The machinery in the carding and spinning departments is all of English make, chiefly Platt Bros. The looms are of the heavy underpick fustian type, and while a part of them are from England the greater number are of native manufacture. A unique feature of this plant is the complete foundry and machine shop connected with it. Here practically all repairs for the machinery are made, and the director of the mill stated that over 600 looms, complete, had been made by them and installed in the factory in recent years.

Wages in the carding and spinning rooms are 18 to 20 pesetas (\$3.22 to \$3.58) per week. The corduroy manufactured is 26½ inches wide, Genoa (2 by 2 twill) ground weave, with 48 picks in the warp and 160 to 220 picks in the filling. The looms run at a speed of 170 picks per minute, and Nos. 28 to 30 two-ply warp and No. 20 filling are used. The production is about 15 yards per day per loom on 200-pick goods, and a weaver running two looms receives 4 pesetas (71.7 cents) per day, thus making the weaving cost of a yard 2.39 cents.

The operatives live in the dwellings grouped about the mill, for which a charge of 1 to 2 pesetas (17.9 to 35.8 cents) per week is made. The "colonia" maintains a church and an excellent school.

COLONIA AND FÁBRICA VIAL.

The Vial mill, which was founded in 1879, is situated at Bauma, about 25 miles from Barcelona, and contains 450 looms and 9,000 spindles. Egyptian cotton is used exclusively (10 bales weekly), and the 25,000 meters of cloth manufactured weekly consists of madapollams, fine sheetings and shirtings, figured and striped serges, and similar grades of goods, woven from No. 60 to No. 80 yarns.

Wages in this factory are somewhat lower than in the Barcelona mills and the working hours are 12 per day. Carders are paid 18 pesetas (\$3.22) per week for tending 15 cards. One woman and one child are required on each roving frame, the former at a weekly wage of 12 pesetas (\$2.15) and the latter at 6 to 8 pesetas (\$1.07 to \$1.43). Ring spinners receive 12 pesetas (\$2.15) per week for tending one frame of 480 spindles, and the spinners are required to doff the frames. On the mule frames of 1,000 spindles each, two men are employed at 24 pesetas (\$4.30) per week and one boy at 8 pesetas (\$1.43). In the weave room from 6 to 7 pesetas (\$1.07 to \$1.25) is paid for each hundred meters of cloth woven. The cost of weaving a madapollam, which is a plain-woven goods similar to batiste, muslin, and cambric, is 6.50 pesetas per 100 meters (1.07 cents per yard). This applies to a cloth 1 meter wide, 92 by 90 picks per inch, 50/1 warp and 60/1 filling; speed of loom, 190 picks per minute.

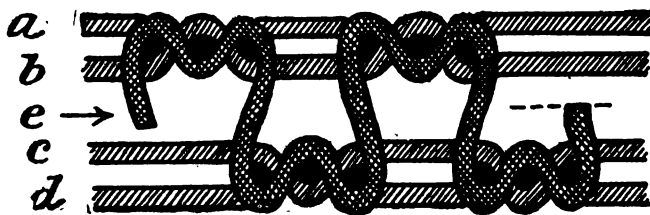
GÜELL Y COMPAÑÍA.

Güell y Compañía have one of the oldest and most successful mills in Spain. It was established as early as 1840, and is located about one hour's ride from Barcelona. The mill village is one of the best and most modern in Spain. Splendid churches and schools, a coop-

erative society that saves the operatives at least 6 per cent in the purchase of all the necessities of life, clean and well-kept houses, paved streets, and electric lights all serve to make the "colonia" one of the show places of Barcelona. The motive power is derived from two steam engines of 800 and 500 horsepower, respectively, using 16 tons of coal, at 30 pesetas (\$5.38), per day. This is equal to about \$18 per horsepower per year for coal alone.

An unusual feature of this mill is that the main building is five stories high, a type of construction rarely found in Spain. The lappers and carding machinery are located on the first and second floors, the weaving on the third, and the spinning on the fourth and fifth. The mill contains 8,400 ring spindles, 16,000 mule spindles, and 600 looms. The machinery is largely from Platt Bros., England, with some of the Howard & Bullough make. One thousand operatives are employed, and the product comprises plush, cotton velvets, and corduroys. The goods manufactured by this mill have an excellent reputation not only at home but also abroad, first prizes having been awarded to the mill at the expositions in Philadelphia, Chicago, and Paris.

The goods are woven in the gray and afterwards dyed in the piece in a great variety of colors. The ground weave of the fabric is the



Design of double plush fabric.

regulation Genoa (2 by 2 twill) back, and the cutting of the filling pile is accomplished by a secret process, which is very jealously guarded. Double-plush fabrics are also manufactured in this mill. In this system of weaving the two plush fabrics are woven in the loom, face to face, being connected by the pile, which passes from one cloth to the other. After the filling is inserted the two cloths are wound on separate cloth rollers, the pile between being cut by a knife, thus leaving a pile face on each fabric. The cutting knife is set between two rollers and is given a reciprocating motion by means of a cam at the side of the loom; thus, when the cloth is drawn forward the pile connecting the fabrics is neatly severed.

By this method, which is now being used to some extent in the mills in Spain, plain velvets and plushes may be manufactured and perfect fabrics obtained, but the process does not lend itself so readily to fancy figured effects. The chief advantage, of course, is the large production that may be obtained by this method.

The illustration is an enlarged section of the weave used, showing two repeats of the pattern. The weave is complete on five ends and six picks; *a* and *b* are ground ends for the top fabric, while *c* and *d* are ends for the bottom fabric; *e* is the pile end passing from one cloth to the other, thus forming the pile on the surface of each when they are cut apart along the dotted line. The drawing is enlarged

in order to show the interlacings of the pile warp more clearly. In practice, of course, the lay of the loom would beat the picks up to each other and make two closely woven fabrics.

The rate of wages in the Güell mill conforms to the average scale already given, and 11 hours constitute a day's work.

HISPANA INDUSTRIAL.

The Hispana Industrial is among the largest cotton mills in Spain, having a capital of 8,000,000 pesetas (\$1,433,600), 1,200 looms, and 23,000 spindles. It is located in the suburbs of Barcelona. Some 1,250 operatives are employed and 60 bales of cotton, chiefly American, are used weekly. Two steam engines of 1,000 and 250 horsepower are used, and the cost of power is given as \$30 to \$35 per horsepower per year for a day run only. The cards are on the first floor and the weaving and spinning machinery on the two floors above. The lapper room is separated from the rest of the mill. The laps, after going through the opener and two scutchers, which, like all the other carding and spinning machinery in this mill, are English, are carried to the cards. There are some 40 cards with $37\frac{1}{2}$ -inch flats. Two processes of drawing are used, with leather-covered rolls and mechanical stop motion. The roving process consists of slubbers of 96 spindles, intermediates with 144 spindles, and fine frames of 180 spindles each. For roving for No. 30 yarn the hank numbers are 0.8, 2, and 5. The ring frames have 400 spindles each and the mules 1,000. The looms are of various makes, but the larger number are English and Spanish. Dobbies and plain and box looms are operated. Complete dyeing and bleaching establishments are connected with the mill.

In the card room the wages are as follows: Picker-room operatives, 3.50 pesetas (63 cents) per day; carders, 3 pesetas (54 cents) for tending 10 cards, including stripping. Workers on draw frames are paid 2.50 to 3 pesetas (45 to 54 cents). Roving-frame tenders are paid by the hank, the weekly wages averaging 16 pesetas (\$2.86). Spinners make 20 pesetas (\$3.58) per week.

The products of the mill are chambrays; drils, which are dyed and printed and also woven from colored yarns; plain sheetings, both gray and bleached; corduroys, and velvets. Weavers earn from 22 to 25 pesetas (\$3.94 to \$4.48) per week. The weaving wage on a dril 26 inches wide, 92 by 40 picks, is 3.50 pesetas per 100 meters of cloth (0.5735 cent per yard), with a loom speed of 190 picks per minute.

KINDS OF CLOTH MANUFACTURED—DRILS.

The range of fabrics manufactured in Spanish mills, in order to meet all the demands of the trade, is extremely wide. The largest division is comprised under the head of colored goods, followed by printed goods, and gray and bleached goods, in the order named. Among the chief productions are colored drils, corduroys and velveteens, napped goods, flannelets, barchent, oxford, percales, piqués, shirting prints, gloria cloth for umbrellas (silk warp and cotton filling), zephyrs, vichys (ginghams), plain sheetings, holandas, Spanish stripes (Guayabera Catalana), mercerized goods, quilts or counterpanes, towels, and handkerchiefs.

The production of the so-called "drils" is very large. These goods are not only sold extensively on the home market, but they form the

chief item in the export trade. The term is not to be confused with the American word "drill," which is usually applied to twilled fabrics only. These drills may be of plain or twill weave and they are always colored, being either dyed in the piece or woven from colored yarns. They are used extensively by the working classes in Spain for men's suits. Railway and street car conductors and the cotton-mill operatives use them altogether in the summer. They are also worn to a great extent in the Spanish Army. Overalls made of denim are not worn in the country, the drill suits, which are of a better quality, being preferred. Aside from the extensive domestic demand these goods are shipped in large quantities to the Philippines and to Central and South America.

The cloth is made up in varying widths, but the largest demand is for the 27½ inch. One of the most popular styles is a black and white pin stripe, weighing 4 yards to the pound, with 128 threads of 2-ply warp (pattern 2 white ends, 2 black ends) and 72 threads of 2-ply black filling per inch. A black stripe one-fourth inch wide is woven in one selvage. The retail price of these goods is 2.50 pesetas (44.8 cents) per meter, while cheaper grades are sold at 1 to 1.50 pesetas (17.92 to 26.8 cents). These drills are made up in a variety of patterns, browns, tans, and grays being the most popular colors. Some of the finer grades are made up with mercerized yarn in imitation of alpaca.

SHEETING AND SHIRTING—OTHER FABRICS.

Next to drills come gray and bleached sheetings and shirtings. These goods are woven from 80 to 120 centimeters (31.49 to 47.24 inches) wide and usually come in pieces of 100 meters, colored goods being sold in 40-meter pieces. A common sheeting largely used is 88 centimeters (34.65 inches) wide, 52 by 52 picks per inch, and weighing from 12 to 23 kilos (26.4 to 50.7 pounds) per 100 meters, the 20-kilo weight being the most popular. The price of the latter, which weighs about 2.82 yards per pound and is made of American and Indian cotton, is 2.45 reals per meter (10.25 cents per yard). In the lighter weight, 12 kilos per 100 meters (4.69 yards per pound), the price is 7.37 cents per yard. It will thus be seen that cheap labor and the use of Indian cotton enable the Spanish manufacturers to produce plain goods of the coarser grades at a lower price than the American manufacturer.

Cotton velvets and corduroys are manufactured in large quantities, the latter being widely used for suits in winter, particularly among the laboring classes. Prints and calicoes, cretonnes, cotton blankets and quilts, umbrella cloths, zephyrs, cotton flannels, fine white and colored dress goods and percales in Jacquard patterns, handkerchiefs, towels, and tablecloths form the other leading classes of goods woven. Every effort is made to supply all the needs of the trade, and the home market is closely studied and foreign goods imitated.

COTTON-GOODS EXPORT TRADE.

The Spanish-American War and the subsequent loss of Cuba, Porto Rico, and the Philippines was a serious blow to the textile interests of Spain. Up to 1897 the cotton manufacturers depended almost entirely upon the colonies for an export market. The trade was large and the profits in the industry were high. In 1890 the

total exports of cotton cloths amounted to 10,385,000 pounds, of which over 10,231,000 pounds, or more than 98 per cent, were shipped to Cuba, Porto Rico, and the Philippines. How changed conditions are to-day is shown by the fact that in 1909 only 4,093,000 pounds of white and colored goods out of 15,300,000 pounds, or 26.7 per cent of the total, were exported to these islands.

DECLINE IN EXPORT TRADE.

A clearer idea of the decline of the export trade in cotton goods is shown in the following table, giving the exports of yarn, cloth, and knit goods from Barcelona during the years 1897-1910:

Years.	Yarn.	White goods.	Dyed and printed goods.	Knit goods.	Total.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1897.....	3,099,895	12,170,715	7,689,552	2,156,114	25,116,276
1898.....	2,421,609	4,070,046	6,250,976	2,265,233	15,007,924
1899.....	451,019	3,348,426	6,346,540	2,798,455	12,944,440
1900.....	1,314,420	2,494,090	5,399,151	2,806,392	12,014,953
1901.....	364,524	1,977,281	4,851,240	2,267,411	9,460,456
1902.....	252,887	1,529,811	4,736,673	2,411,202	8,930,573
1903.....	289,938	1,269,618	5,571,004	2,462,873	9,623,433
1904.....	449,540	1,030,518	7,250,799	3,167,276	11,898,133
1905.....	528,449	852,000	10,463,735	3,921,611	15,766,395
1906.....	512,173	860,504	9,322,605	2,896,948	13,592,230
1907.....	682,747	1,365,302	9,429,237	3,464,941	14,960,227
1908.....	631,375	1,630,760	6,795,466	2,130,832	11,188,433
1909.....	731,140	1,983,454	12,685,467	2,782,234	18,182,315
1910.....	1,124,394	569,069	9,177,280	2,219,732	13,121,075

EFFORTS TO EXTEND EXPORT TRADE.

After Spain's loss of its colonies and the subsequent decline in trade the Catalonian manufacturers faced a crisis. In looking for new markets they naturally turned to the countries of South America, where similarity of race, language, and customs favored them, and an active campaign was inaugurated. In 1901 a Bureau of Commercial Information was established in the Ministry of State in Madrid. In 1903 a Spanish commission, consisting of delegates from the industrial and commercial centers of the country and under the auspices of the Fomento del Trabajo Nacional, sailed for Buenos Aires for the purpose of studying the South American markets and reporting to the manufacturers exactly what goods were required in the different countries visited. Samples of the kinds of goods sold in those markets were sent home, publicly exhibited, and copied by the manufacturers.

It is realized that Spain must look to South America in expanding its export trade, and everything possible is being done to enable the home industry to compete successfully with the United States, Germany, England, and France. Since 1901 Spanish-American chambers of commerce have been organized in many of the important cities of Spain for the purpose of studying conditions in America and finding new opportunities for introducing Spanish products. There have been established a number of periodicals and journals devoted to Spanish-American trade, containing articles and information that may interest and aid the home manufacturers. There is a strong sentiment in the country in favor of the adoption of commercial

treaties with the South and Central American republics, and to this end Spain has recently extended to Cuban products admission at the minimum rates of duty. The manufacturers took an active interest in the expositions in Argentina and Chile in 1908, and sent over extensive exhibits. In order to provide better banking facilities, the Bank of Spain has established branches in several of the important cities in South America.

During the current year the Casa de America was organized in Barcelona. It is a club founded for the purpose of promoting social relations between the Spanish people and South Americans, many of whom reside part of the time in Barcelona. Everywhere one finds evidence of the attention that is being given to the trade opportunities in Argentina, Chile, Ecuador, Mexico, Porto Rico, Cuba, and other Latin American countries. Trade directories and statistical information relating to them are published and widely distributed.

An important aid to all these efforts is the emigration to South America in recent years. In 1909 the total number of emigrants from Spain was 191,761, of whom more than 103,000 embarked for Argentina.

BARCELONA COMMERCIAL MUSEUM—GOVERNMENT ASSISTANCE.

With the object of increasing trade a Commercial Museum was established in Barcelona in 1909. While it has been made a "corporación nacional" by the King of Spain, it has received no aid from the Government, being supported wholly by exporters and manufacturers. It has subscribers all over Spain and it has enjoyed a remarkable growth. The subscribers exhibit their products in the museum, paying 180, 300, or 500 pesetas (\$32.25, \$53.76, or \$89.60) annually, depending on the size of space occupied. In addition, subscribers are entitled to an advertisement in the Revista Mundial, the organ of the museum, 5,000 copies of which are distributed monthly in all parts of the world. The museum is not confined to Spanish manufactures, however, foreign exhibits being solicited as well. Products for exhibition are admitted free through the custom-houses.

Not only have manufacturers made efforts to secure foreign markets for their goods, but assistance was also offered by the Government to operatives going abroad to perfect themselves in their various crafts. One hundred grants were made under this plan in 1903-4. The amount allowed was \$3,000 monthly, in addition to traveling expenses. The men were entitled to any wages they earned, but this amount was deposited by the engineer in charge of the expedition with the Spanish consuls at Paris and Brussels. To the two artisans who most distinguished themselves \$150 each was awarded in addition.

FORMATION OF EXPORT ASSOCIATION.

The cotton manufacturers of Spain who had felt most keenly the loss of trade met in Barcelona in June, 1907, to consider what steps could be taken to dispose of the large stock of goods that had accumulated as a result of the gradual cessation of exports to Cuba, Porto Rico, and the Philippines. It was decided that an association should be formed to promote the exportation of such goods as could not be sold in the Peninsula and to indemnify exporters for the loss entailed

by sending Spanish goods to countries where they were little known. It was hoped that by this means all the mills in the district might be kept running and that the good prices obtained for manufactures sold in Spain might, in great measure, compensate for the loss on those sent to foreign markets.

The owners of mills representing 83 per cent of the entire industry in Spain joined the society, which was started in July, 1907, under the title of *La Mutua de Fabricantes de Tejidos* (Mutual Association of Cotton Weavers). The association was managed by 5 directors, assisted by a council of 15 members, all manufacturers. Each member paid an entrance fee of \$100 and incurred a liability to pay all calls made upon him by the directors, in proportion to the number of looms he had running in his mill.

WORK OF LA MUTUA—DISSOLUTION OF ORGANIZATION.

Up to August 31, 1909, the date of the last balance, under the system of premiums on exportation instituted by *La Mutua*, Spanish goods had been sent to 176 markets, principally in Eastern countries, where they had formerly been unknown. These goods consisted of 920,425 pieces of 100 meters each, weighing 8,196 tons and valued at \$7,500,000. To reimburse the manufacturers for the loss sustained by the sale of these goods in foreign markets, heavy calls had constantly been made on all members of *La Mutua*, and, as usually happens in such cases, great discontent began to be shown by the subscribers. It was contended that the sacrifice was out of proportion to the results obtained. The policy of the directors in sanctioning the exportation of 25,000 pieces of Spanish cretonne to Manchester (which seemed very like sending coal to Newcastle) was severely criticized, and several members refused to contribute to the very heavy loss entailed by this experiment, protests were made, legal proceedings followed, and the relations between directors and shareholders became very unsatisfactory.

As the directors experienced great difficulty in persuading members to pay their subscriptions, it was suggested that an application should be made to the Government for pecuniary assistance, and in the summer of 1909 a petition was presented to the Minister of Finance praying that a grant equivalent to the amount paid by the members of *La Mutua* in customs duties on raw materials imported by them during the previous two years should be made to the association. The Government was at first disposed to grant the petition, but while negotiations were in progress reports of the dissensions among members of the association reached Madrid, and the expected aid was refused.

Matters went from bad to worse, and a motion was made, February, 1910, that the association be dissolved, but the managing director stated that the suppression of *La Mutua* would be a public disaster, entailing, as it would, the closing of many mills, and the motion was defeated by a narrow majority. It was, however, resolved that no further premiums on exports should be paid for a period of eight months and that efforts be made to strengthen the organization and make its operations beneficial to all members. However, this proved to be the beginning of the dissolution, and in April, 1910, steps were begun looking toward the liquidation of the unique organization.

TREND OF BARCELONA'S EXPORT TRADE.

The result of these two organized efforts with regard to the South American and Eastern trade has been to increase the exports of cotton goods in those markets. The shipments of yarn, cloth, and knit goods from Barcelona in 1897, 1905, and 1910 are given, by countries, in the following table:

Countries.	1897	1905	1910
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Argentina.....	49,394	1,320,123	3,417,875
Brazil.....	2,359	69,615	20,501
Chile.....	2,125	202,766	781,429
Colombia.....	57,485	615,588	432,233
Cuba.....	9,500,364	4,904,818	3,271,825
Ecuador.....		128,279	100,100
Mexico.....	87,469	449,229	487,090
Philippines.....	11,629,913	2,176,584	957,278
Porto Rico.....	3,275,306	44,936	104,875
Portugal.....	10,002	79,762	49,513
United States.....	126	201,441	117,611
Venezuela.....	36,883	152,296	264,978
All other countries.....	464,830	5,422,058	3,115,172
Total.....	25,116,276	15,766,395	13,121,075

It will be noticed that the exports to Cuba, Porto Rico, and the Philippines were 24,405,603 pounds in 1897, or more than 95 per cent of the total, whereas in 1910 they amounted to only 4,333,973 pounds, or about 33 per cent of the whole. On the other hand exports to the Central and South American countries increased from 235,715 pounds in 1897, or less than 10 per cent of the whole, to 5,504,806 pounds, or 42 per cent of all the exports, in 1910.

EXPORTS FROM SPAIN, BY COUNTRIES AND BY CLASSES.

The exports of cotton goods from Spain in 1906 and 1909, by countries and by classes, were as follows:

Countries.	Yarn.		White goods.		Dyed and printed goods.		Knit goods.	
	1906	1909	1906	1909	1906	1909	1906	1909
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Argentina.....	90,375	98,519	135,298	226,137	1,405,259	2,863,085	67,500	99,017
Canary Islands.....	34,246	21,936	29,720	290,046	1,346,347	810,301	81,131	104,445
Canta.....			17,802	22,249	6,050	1,380	816	1,493
Chile.....		1,508	43,016	85,254	336,415	444,401	56,943	109,571
Colombia.....	679		21,808	13,338	471,751	326,871	334,356	291,340
Cuba.....	106,957	153,599	344,473	69,429	3,031,283	3,877,128	255,308	282,336
Ecuador.....		1,554	9,345	8,562	32,961	84,068	56,508	75,109
Fernando Po.....	48		6,071	25,225	44,465	45,080	3,104	9,520
France.....		15,000	74,279	659,517	98,912	1,709,445	127,860	418,080
Germany.....			5,866	1,206	18,818	10,174	38,874	46,010
Italy.....	4,400	2,645	58,536	13,069	465,523	279,365	236,137	48,971
Mexico.....	197,336	234,536	79,176	41,490	341,583	132,653	30,379	17,956
Panama.....				9,905		121,531		141,489
Peru.....			25,044	3,560	20,333	4,895	47,322	17,466
Philippines.....	41,367	51,124	28,702	33,078	539,553	311,704	1,121,074	862,991
Porto Rico.....	229		6,495	60,639	21,852	15,311	15,311	3,807
Portugal.....	6,675	6,916	153,489	39,123	127,139	17,782	32,483	5,331
Turkey.....	6,184		4,017	491,705	251,080	1,038,348	21,991	
United Kingdom.....	6,363	95,948	2,236	5,593	69,648	36,751	46,413	44,156
United States.....			3,734	3,596	83,993	85,106	5,104	15,450
Uruguay.....	5,459	51,118	24,235	17,350	499,307	494,514	35,686	28,662
All other countries.....	23,471	14,026	47,020	77,923	185,350	410,107	314,665	184,839
Total.....	523,789	748,429	1,120,342	2,145,761	9,436,409	13,186,541	2,928,965	2,806,071

The foregoing shows that Cuba and Argentina are the leading markets for cotton goods. Apparently France was one of the principal buyers, but in reality only a small amount was destined for French markets, the remainder being reexported. Mexico, Cuba, and Argentina are the principal purchasers of yarns. The yarn shipped to Cuba, however, is mainly sewing thread, as there are no cotton mills there. The best market for knitted fabrics is the Philippines, followed by Colombia and Cuba.

EXPORTS FROM BARCELONA IN 1910.

The effect of the efforts of La Mutua is clearly shown in the exports to Turkey. White goods shipped to that country increased from 4,017 pounds in 1906 to 491,705 in 1909, while colored goods increased from 251,080 pounds in 1906 to 1,036,171 in 1909. That the sales in Turkey, however, were to a large extent artificial and due to the efforts of La Mutua is shown in the following preliminary statistics of the exports of cotton goods from Barcelona in 1910:

Countries.	Yarn.	White goods.	Dyed and printed goods.	Knit goods.	Total.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Argentina.....	444,846	140,884	2,746,822	85,313	3,417,875
Brasil.....	8,081	4,901	6,673	686	20,501
Chile.....	7,297	8,225	681,014	84,893	781,429
Colombia.....	723	16,879	222,336	192,295	432,233
Cuba.....	189,095	48,003	2,735,884	288,843	3,271,825
Ecuador.....	1,543	3,501	36,151	58,905	100,100
Fernando Po.....		14,085	33,935	6,217	54,237
France.....	5,626	115,125	256,776	154,814	532,341
Germany.....		207	20,721	44,778	65,706
Italy.....		35,223	199,287	28,979	263,489
Mexico.....	209,921	25,670	210,391	41,706	487,691
Morocco.....	714	5,809	10,953	1,369	18,845
Panama.....	154	10,366	108,680	113,420	232,620
Peru.....		10,845	27,484	41,355	79,684
Philippines.....	61,665	13,844	185,513	696,251	957,273
Porto Rico.....	46,995	5,549	41,222	11,109	104,875
Portugal.....	11,859	3,690	32,842	1,122	49,513
Santo Domingo.....		4,081	74,260	19,625	97,966
Turkey.....		110,810	346,078	55,380	512,268
United Kingdom.....	113,557	968	86,506	44,804	245,835
United States.....		4,760	98,089	14,762	117,611
Uruguay.....	13,697	7,134	883,509	45,937	950,277
Venezuela.....	974	5,015	98,756	160,233	264,978
All other countries.....	7,697	4,085	33,398	16,723	61,903
Total.....	1,124,394	599,669	9,177,280	2,219,732	13,121,075

Despite the decreased demand in Turkey the cotton manufacturers are still determined to secure an outlet for their products not only in Turkey but in the Balkans. They are being urged to visit those countries, ascertain the needs, procure samples, and manufacture cheap imitations of them. The Catalonian manufacturers, however, although skillful imitators, are somewhat lacking in business initiative, and it is doubtful if there will be any expansion of trade in countries where the advantage of similarity of race and language is wanting.

SHIPMENTS TO THE PHILIPPINES.

Spain's trade in cotton goods in the Philippines has shown a rapid decline. Exports to these islands, which amounted to \$885,206 in 1906, were only \$516,581 in 1910. The trade is to-day made up largely of cheap knit goods, dyed drils, umbrella cloths, and handkerchiefs. The knit undershirts shipped to the Philippines are sold at prices ranging from 14 to 20 pesetas (\$2.50 to \$3.58) per dozen. Following is a typical invoice of knit undershirts shipped to Manila:

Items.	Pesetas.
135 dozen undershirts, at 15.37 pesetas.....	2,074.95
15 dozen undershirts, at 14.87 pesetas.....	223.05
135 dozen undershirts, at 16.62 pesetas.....	2,243.70
15 dozen undershirts, at 16.12 pesetas.....	241.80
	4,783.50
Less discount.....	669.62
	4,113.88
Boxing.....	90.00
Fees.....	14.15
Shipping.....	7.50
Docketing and drayage.....	5.15
Embarking.....	5.70
	122.50
	4,236.38
Commission.....	127.08
	4,363.46
Freight.....	154.10
	4,517.56
Total.....	

FABRICS SOLD TO LATIN AMERICA.

The remarkable growth in the exports to Argentina has already been mentioned. Goods shipped to this country are not confined to any one line, although dyed and printed fabrics predominate. In these fabrics Spain ranks fourth as a supplier of Argentina's needs, following England, Italy, and Germany. These goods are mostly drils and trouserings. The exports of corduroy and velvets to Argentina alone are more than the amount shipped to all other countries. Hosiery, handkerchiefs, and yarn for matches make up the remainder of the exports.

In Cuba, Mexico, Colombia, Chile, and other Latin American countries Spain finds an outlet for drils, knit goods, cotton blankets, and handkerchiefs. Every effort is made to meet all the conditions of the trade. While the products are usually sold through brokers, samples are prepared in an attractive manner, goods are packed in cases or bales, as wanted, and large assortments are given if requested. The cheaper drils are usually put up wide fold, 40 meters to the piece, while the better grades are narrow fold.

Exports to Porto Rico are principally holandas, made of all cotton and of cotton and linen mixed. These goods are usually 85 to 86 centimeters (33.46 to 33.85 inches) wide, 56 by 60, 72 by 56, and 80 by 72 threads per inch, and 3 to 4 yards per pound. [A full line of samples of the leading kinds exported, with prices, is filed in the Bureau of Manufactures.]

CONSTRUCTION AND PRICE OF DRILS—SAMPLE INVOICE.

The perfection attained by the Catalonians in the manufacture of drils is shown by the fact that a market for the better grades with a silk finish has been found in the United States, and one mill in Spain is especially devoted to supplying this trade.

Numerous samples of these goods are filed in the Bureau of Manufactures. One sample (No. 42) is woven 70 centimeters (27.56 inches) wide, 90 by 56 picks per inch, 2-ply yarn, weighing 0.26 pound per square yard, and the price in Barcelona is 1.30 pesetas (23.32 cents) per meter (39.37 inches), less 6 per cent discount. Another sample (No. 43), which is also a dril, is 67 centimeters (26.37 inches) wide, 87 by 52 picks per inch, 2-ply yarn, weighing 0.39 pound per square yard. The price in Barcelona is 1.20 pesetas (21.5 cents) per meter, less 6 per cent. A third sample (No. 44) is a so-called holanda cotton dril, 29½ inches wide, 76 by 76 picks per inch, 4.50 yards per pound. The price in Barcelona per meter is 0.95 peseta (17 cents), less 6 per cent. The first two fabrics are packed 52 and 53 pieces to the case, each piece about 50 yards, while the holanda is put up in 40-yard pieces, 30 pieces to the case.

Following is an invoice covering these goods:

Items.	Pesetas.
2 cases dril (gross weight, 712 kilos; tare, 114.23 kilos; net 597.77 kilos): 52 pieces, 2,555.58 yards 53 pieces, 2,726.60 yards 5,282.27 yards, or 4,829.84 meters, at 1.30 pesetas.....	6,278.80 376.70 5,902.10
Less 6 per cent discount.....	
2 pieces dril, 23 yards, 21 meters, at 1.20 pesetas.....	25.20
Less 6 per cent discount.....	1.50
	23.70
1 case (gross weight 147 kilos; net, 120 kilos): 30 pieces holanda dril, 1,176.7 yards, or 1,076.7 meters at 0.95 peseta.....	1,022.85 61.35
Less 6 per cent discount.....	
	961.50
Total.....	6,887.30
Packing, paper, etc.....	39.50
Commission, 2½ per cent.....	173.17
Fees.....	19.85
	232.52
Total.....	7,119.82

Cotton-thread waste is also shipped to the United States in large quantities (to the value of \$67,000 in 1910). The price in Barcelona is 10.71 cents per kilo. Similar waste in America is sold at 5½ to 6 cents per pound. The charges on a shipment to New York of 24,493 kilos of this waste, costing 55½ centimes per kilo, or 13,593.60 francs, were: Loading, 182.50 francs; freight, 500 francs; fees, 13 francs; total, 795.50 francs. The cost of the waste landed in New York, therefore, was 14,389.10 francs.

SHIPPING SUBSIDIES.

Spain has several steamship lines for the transportation of its products to North and South American ports and the Philippines. The largest of these is the *Compañía Trasatlántica*, which maintains monthly services and receives subsidies as follows: For a monthly service from a port in southern Spain to Montevideo and Buenos Aires, with connections for Valparaiso, \$300,404; from a port in northern Spain to Habana and Vera Cruz via New York, with connections for Quebec and Montreal, as well as New Orleans and the important Atlantic ports of the United States, \$246,242; from a port in eastern Spain to Porto Rico, Habana, and Colon, with connections via Isthmus of Panama to Chile and San Francisco, \$269,721; from a port in northern Spain to Habana and Vera Cruz, \$252,423; from a Spanish port to ports of Morocco and Fernando Po, \$148,161; for a service every four weeks from a port in northern Spain to Singapore and Manila, with connections for ports in the Baltic and North Seas, also with Cape Town, Mozambique, Zanzibar, Saigon, Hong-kong, Yokohama, etc., \$448,683.

The *Linea Pinillos* maintains a service from Barcelona to Santos, Montevideo, and Buenos Aires with sailings every 24 days, and a biweekly service to Cuba, Mexico, and Central American Republics. The *Lloyd Italiana*, the *Hamburg Amerika Line*, and the *Compagnie des Messageries* are other lines carrying the trade of Spain to Latin American and other countries, either direct or through transshipment at some other port.

FREIGHT RATES ON COTTON GOODS.

Following are the freight rates on cotton goods from Barcelona to the principal points to which the products are shipped:

From Barcelona to—	Rate.	
	Pesetas.	American currency.
Manila, per cubic meter, plus 10 per cent primage.....	47.50	\$8.51
Habana, per cubic meter, plus 10 per cent primage.....	40.00	7.17
San Juan, Porto Rico, per cubic meter, plus 10 per cent primage.....	40.00	7.17
New York City, per cubic meter, plus 10 per cent primage.....	30.00	5.37
Buenos Aires, per cubic meter, plus 10 per cent primage.....	30.00	5.37
Vera Cruz, per cubic meter, plus 10 per cent primage.....	45.00	8.06
La Guaira, Venezuela, per cubic meter, plus 10 per cent primage.....	40.00	7.17
Constantinople, per ton.....	¹ 37.00	7.14

¹ Francs.

The exact equivalent of a cubic meter is 35.314 cubic feet, and there are about 40 cubic feet to 1,000 kilos (2,204.6 pounds).

The freight rate from New York to Habana is 10 cents per cubic foot; to Buenos Aires, 10 cents per cubic foot; to Vera Cruz, \$8.23 per ton; to La Guaira, 12 cents per cubic foot, plus 5 per cent primage; to Constantinople, 18s. to 20s. (\$4.38 to \$4.87) per ton.

OTHER TEXTILE INDUSTRIES.

The woolen, silk, linen, and jute industries in Spain are of minor importance. While they practically supply the home market, there are no exportations of any consequence. The following table shows the imports and exports of textiles, other than cotton, at Barcelona during 1909 and 1910.

Articles.	Imports.		Exports.	
	1909	1910	1909	1910
Wool and hair:	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Raw.....	2,467,748	2,763,323	3,443,722	2,158,028
Yarn.....	33,106	27,541		
Manufactures.....	145,091	123,512	356,450	425,570
Hemp, flax, and other fibers:				
Raw.....	30,473,005	19,908,939		
Yarn.....	3,329,687	3,600,438	38,729	69,595
Manufactures—				
Shoes.....			1,956,729	1,939,068
Cloth.....	45,883	81,006	205,605	258,018
Silk:				
Raw.....	464	3,163		
Yarn.....	48,587	46,136		
Manufactures.....	17,800	22,103	17,455	30,952

¹ Dozen.

WOOLEN INDUSTRY.

The total number of looms employed in the woolen industry is 8,000, and of spindles, about 200,000. In the principal factories raw material is spun and woven in the same establishment. The native wool is used to some extent, but nearly 3,000,000 pounds of combed and washed wool are imported annually at Barcelona, chiefly from Bradford (England) and France. Shearing time in Spain is in May, June, and July, and the latest improved machinery is used. Wool combing is only beginning in Spain, and the manufacturers find it cheaper to import the combed and washed wool.

The mills are located at Tarassa, Sabadell, and Barcelona in the north, and at Valencia, Seville, and Granada, and in the Balearic Islands. The value of the annual output is about \$20,000,000 and comprises plain woolen cloths for men's clothing and women's dresses, blankets, shawls, and underwear. The cloth manufactured is of very good quality, and a suit of clothes made from the best grade can be bought for \$15 to \$20.

The woolen manufacturers are organized and are endeavoring at present to find a foreign market for their goods. Conditioning plants have been established at Tarassa and Sabadell by the association for conditioning woolen yarns, and the results are said to equal those at Verviers, Belgium, and other similar plants in Europe. Industrial schools have also been established.

LINEN AND SILK INDUSTRIES.

There are only 40 linen factories in Spain, operating 20,939 spindles and 2,500 looms. The total capital, as stated by a prominent linen manufacturer, is 15,000,000 pesetas (\$2,688,000), and the

annual product 17,000,000 pesetas (\$3,046,400). Eighty-five per cent of the factories are in Barcelona, the remaining ones being situated in Saragossa, Renteria, Seville, Padron, Zamora, Zaranz, and Pamplona. Weaving alone has developed to a certain extent, particularly in Granollers. The output consists of batistes, or holandas, and handkerchiefs, wearing apparel, table linen, and towels.

Although Spain was the first occidental nation to engage in the manufacture of silk, the industry has rapidly declined from the position it formerly held. Barcelona is one of the principal centers, although factories are established at other ports of Spain. As a rule, spinning is not engaged in, the silk yarn being imported from abroad, chiefly Italy. There are about 2,000 looms in Spain, the product of which is valued at \$8,000,000, consisting chiefly of coarse cloths, plain black and colored goods for clothing, surahs, velvets, scarfs, damask, and covers for church ornaments.

HEMP AND JUTE.

The hemp and jute industry in Spain is also insignificant, the total annual value of the product being about \$4,000,000. Besides rope and bags, large quantities of shoes and alpargatas are manufactured. The latter, which are low sandals, are worn by the working class throughout the year and are sold in the stores at 20 and 30 cents per pair. There is also a good demand for them in Latin-American countries, to which thousands of pairs are exported annually.

PORTUGAL.

GENERAL TRADE CONDITIONS.

Portugal occupies a minor position among the cotton-manufacturing countries of the world. The total number of spindles (500,000) is not much in excess of the number in some one of the larger mills in England and Germany. Cotton manufacturing is, however, the leading industry of the country, and at the present time (May, 1911) is in a rather prosperous condition as contrasted with a world-wide depression in the textile trade. Three contributing causes have brought about this rather remarkable state of affairs: (1) The demand for cotton goods in the Portuguese colonies of Africa, a market controlled exclusively by the native mills, (2) the high prices obtained for rubber, cork, and wine, and (3) the high tariff on cotton goods.

AGRICULTURAL INDUSTRIES.

Portugal contains 34,254 square miles (about the size of the State of Maine) and the population in 1900, the last official census, was about 5,000,000. The chief occupation is agriculture, the returns showing that more than 3,250,000 people are engaged in this branch, while slightly more than 1,000,000 are employed in various industries.

Of the total area of Portugal 2.2 per cent is under vineyards, 7.2 per cent under fruit trees, 12.5 per cent under cereals, 2.7 under other crops, 29.6 per cent under forest and pasture, and 45.8 per cent is unproductive. The large area not under cultivation is due partly to the lack of capital and farmers and partly to the character of the country; yet it has been asserted that in the mountainous districts of the east there are from 2,000,000 to 4,000,000 hectares (hectare = 2.47 acres) now untilled that are susceptible of cultivation.

In the north peasant proprietorship prevails; the land is divided into small tracts, and "petite culture" is practiced. In the south large properties and tenant farming are common. The chief cereal and animal products of the country are: In the north, maize and oxen; in the mountainous region, rye, sheep, and goats; in the central region, wheat and maize; and in the south, wheat, maize, and swine.

Throughout the country wine is produced in large quantities, the lighter kinds being peculiar to the south, while the heavy wines are made in the north; large quantities of port wine are shipped to all parts of the world from Oporto. Portugal also possesses considerable mineral wealth, but, for lack of capital and on account of inadequate transportation facilities, valuable mines (copper, iron, and cuprous iron pyrites) remain unworked.

The methods adopted in the cultivation of the land are almost primitive, the old Moorish plow still being in use on some of the farms. The people seem slow to adopt improved methods of cultivation and modern agricultural implements and machinery. The small

farmers in the north are too poor to buy agricultural machines, but there is undoubtedly a market for them in the south. American manufacturers are not well represented and the bulk of the trade in this line is held by the English. If a progressive firm would undertake a campaign of enlightenment among the farmers, a policy that has been pursued in other markets of the world, there is every reason to believe that a good business might be done in agricultural implements and machinery.

FISH PACKING—AMERICAN GOODS.

The preserving and packing of sardines forms an important industry in Portugal and large quantities of olive oil are imported for this purpose, chiefly from Spain and Italy. A drawback is allowed when this oil is reexported with the sardines, but the same privilege is not accorded to seed oil. Undoubtedly there would be a good market for American seed oils if they were allowed the same drawback.

In the city of Lisbon practically all the street railway cars are of American manufacture. To such an extent is this true that the term "American" is often used by the natives to designate the street car. American illuminating and lubricating oils, typewriters, sewing machines, and cash registers are being sold in increasing numbers, the trade in these lines being held almost exclusively by the United States. American automobiles have not been introduced to a great extent, but there is a field for a moderately priced car, strongly built, and the few that have been sold in the country have attracted notice and excited favorable comment.

TREND OF FOREIGN COMMERCE.

Statistics of the commerce and industries of Portugal are difficult to obtain and are not considered accurate. The latest complete annual statistics compiled are for 1907. However, statistics of the trade passing through the ports of Lisbon and Oporto during the six months ending June 30, 1910, have recently been published, and they cover practically all the foreign trade excepting overland imports from and exports to Spain.

The foreign commerce of Portugal consists of exports valued at about \$30,000,000 and imports of about \$65,000,000 annually. Without a break, imports have considerably exceeded exports since 1865. Exports show only a limited gain, while imports have nearly doubled in the past 30 years. The following table gives the total imports and exports in round figures, for the years 1901-1907 and for the six months ending June 30, 1910:

Years.	Imports.	Exports.	Total.	Years.	Imports.	Exports.	Total.
1901.....	\$57,800,000	\$28,300,000	\$86,100,000	1906.....	\$80,700,000	\$29,000,000	\$89,700,000
1902.....	55,600,000	28,400,000	84,000,000	1906.....	60,400,000	30,600,000	91,000,000
1903.....	58,900,000	30,600,000	89,400,000	1907.....	60,200,000	29,900,000	90,100,000
1904.....	62,100,000	30,700,000	92,800,000	1910 (6 months)	31,000,000	12,500,000	43,500,000

The imports from Spain in 1909 amounted to \$8,729,568 and the exports thereto were \$8,687,879.

The foregoing figures include the imports entered for consumption and the exports of domestic products. The products of the Portuguese colonies pass through the port of Lisbon, owing to the reduced export duties levied on products shipped to Portugal. The reexports of colonial produce amounted to \$14,000,000 in 1910, an increase of about 15 per cent over 1909.

DISTRIBUTION OF FOREIGN TRADE.

The imports into and exports from Lisbon and Oporto, by countries, during the six months ending June 30, 1910, were as follows:

Countries.	Imports.	Exports.	Countries.	Imports.	Exports.
Belgium.....	\$1,253,207	\$235,676	Spain.....	\$292,850	\$124,362
Brazil.....	604,131	3,170,945	United Kingdom.....	9,348,915	3,121,129
France.....	2,965,823	168,722	United States.....	3,612,061	442,340
Germany.....	5,088,212	770,621	All other countries.....	5,392,522	908,477
Portuguese Africa.....	1,251,040	3,408,651	Total.....	31,071,310	12,499,316
Russia.....	1,262,529	248,393			

As may be seen from the foregoing table, the United States ranks third as a supplier of Portuguese needs and fifth as a buyer of Portuguese products, if Spain's overland trade with Portugal is not taken into consideration. Of the exports from the United States to Portugal during the period mentioned raw cotton was the leading article, amounting in value to \$2,750,000. The other articles were staves, lumber, oils, machinery, and wheat. In addition to the exports to the United States included in the preceding table, produce from the colonies is reexported to America in large quantities, the principal articles under this head being cork, india rubber, and cocoa. The value of these three articles imported into the United States from Portugal during the fiscal year 1910, according to American statistics, was \$1,888,738, \$1,469,733, and \$1,375,674, respectively. The imports from Portugal proper consisted of sulphur ore, hides and skins, wine, wine lees, and sardines.

PRINCIPAL IMPORTS AND EXPORTS.

The following table shows the value of the leading articles (including colonial products) imported and exported by Portugal during the six months ending June 30, 1909 and 1910:

Articles.	1909	1910	Articles.	1909	1910
IMPORTS.			IMPORTS—continued.		
Coal.....	\$2,034,033	\$2,189,942	Wool.....	\$526,798	\$558,549
Cotton, raw.....	2,111,388	2,791,296			
Cotton goods.....	1,635,132	2,209,719	EXPORTS.		
Fish.....	2,197,542	2,183,572	Cocoa.....	4,134,679	4,188,613
Hides and skins.....	827,847	1,237,679	Cork.....	2,051,661	2,330,453
Linen goods.....	429,313	498,866	Cotton goods.....	766,668	1,322,556
Lumber and wood.....	973,518	822,602	Fish, fresh and canned.....	1,021,727	1,190,082
Oils.....	325,844	314,751	Fruit and vegetables.....	973,413	1,354,467
Rice.....	862,455	907,559	Minerals.....	640,069	760,118
Silk.....	624,028	748,726	Rubber.....	1,833,907	2,687,234
Sugar.....	1,294,109	1,210,615	Wine.....	4,679,368	6,017,667
Wheat.....	4,056,077	2,528,907			

AMERICAN TRADE WITH PORTUGAL.

The following table, compiled from United States statistics, shows the value of the imports from and exports of domestic merchandise to Portugal during the fiscal years ending June 30, 1908, 1909, and 1910:

Articles.	1908	1909	1910
IMPORTS.			
Cocoa.....	\$1,224,471	\$2,484,677	\$1,375,674
Cork, and manufactures of.....	1,345,551	1,240,337	1,940,562
Fish: Anchovies and sardines.....	318,290	267,085	346,036
Rubber.....	1,201,787	1,025,532	1,469,733
Skins, goat.....	81,602	356,285	370,434
Sulphur ore.....	254,584	244,970	291,083
Wine.....	188,494	206,166	310,462
Wine lees.....	224,935	193,645	195,394
All other articles.....	128,208	218,845	208,295
Total.....	4,967,922	6,240,562	6,507,733
EXPORTS.			
Cotton, raw.....	1,180,796	1,246,411	1,630,257
Iron and steel, and manufactures of.....	150,568	157,364	161,306
Oils:			
Mineral.....	442,537	320,322	308,975
Other.....	119,308	127,218	142,671
Wheat.....	323,018	1,248,408	8,640
Wood, and manufactures of.....	579,901	538,355	629,963
All other articles.....	282,370	261,477	346,906
Total.....	3,078,498	3,869,555	3,223,724

These figures do not include all the imports and exports, owing to the fact that a considerable amount of goods in the Portuguese-American trade is transshipped at Liverpool and Bremen. This is particularly true in the case of raw cotton. It will be noted that the exports of wheat from the United States declined from \$1,248,408 in 1909 to \$8,649 in 1910. This is due to the fact that the importation of this article is absolutely prohibited in years when the domestic crop is good, while a fixed amount may be brought in when the crop in Portugal is poor.

COTTON-GOODS TRADE.

An idea of the kinds of cotton goods imported may be gathered from the following statistics showing the amount of each class imported during the first six months of 1909 and 1910:

Articles.	1909	1910	Articles.	1909	1910
Piece goods:			Cotton yarn.....	\$50,352	\$99,576
Colored.....	\$479,436	\$674,477	Twine and sewing thread.....	61,188	49,382
Bleached.....	540,536	608,389	All other articles.....	191,246	198,600
Gray.....	88,753	296,367	Total.....	1,635,132	2,209,719
Embroidery, lace, and similar fabrics.....	135,877	170,262			
Knit goods.....	87,744	112,676			

There was an increase in 1910 over the corresponding period of 1909 in all the classes enumerated except twine and sewing thread. The increased imports of cotton yarn were due to the more extended use of the finer numbers in manufacturing higher grades of cloth,

several weaving mills having been established for this purpose in recent years. The increase in the imports of gray goods was due to a larger demand in the African colonies. To supply this market, which is practically monopolized by Portugal, print cloths are purchased abroad, bleached and printed in the domestic print works and reexported to the colonies.

EXPORTS OF COTTON MANUFACTURES.

The exports of cotton goods from Portugal during the six months ending June 30, 1909 and 1910, were as follows:

Articles.	1909	1910
Piece goods:		
Dyed and printed	\$517, 406	\$971, 530
Gray and bleached	116, 577	183, 078
Cotton yarn	1, 514	2, 881
All other articles	132, 172	166, 077
Total	766, 668	1, 322, 566

A little over 70 per cent of these goods was shipped to Portuguese Africa, the remainder going to Brazil.

UNITED KINGDOM DOMINATES IMPORT TRADE.

The predominance of the United Kingdom in the cotton-goods import trade is shown by the fact that during the first half of 1910 it supplied \$1,450,206 of the \$2,056,409 worth of cotton goods imported through Lisbon and Oporto. The amount supplied by other countries was as follows: Germany, \$360,971; France, \$130,629; Spain, \$9,874; Belgium, \$8,980; United States, \$3,131; all other countries, \$92,618.

The United Kingdom furnishes more than 90 per cent of the piece goods and 75 per cent of the finer grades of colored goods, zephyrs, shirtings, etc. In addition to the fact that Manchester manufacturers are able to produce a high quality of goods at a low cost there are other reasons for this predominance. Ships sailing from England to South America make Oporto (Leixoes) and Lisbon ports of call, and as these boats make fast and frequent trips a very direct and efficient line of communication is enjoyed by the two countries. It is sometimes possible to order goods from England and secure delivery in the same week. Moreover, there is a large colony of English people in both Lisbon and Oporto, and there is a natural inclination on the part of the local merchants to import English goods. Manchester manufacturers are represented on the spot by resident agents. Twice each year, in the spring and in the fall, salesmen are sent out and they remain in the country for two months, showing new lines of samples and coming in touch with the trade.

Portuguese merchants demand long credits and six months net are the usual terms, although the time of payment is extended even further than this in many instances. There are very few losses as a result of long credits and since it is the custom in the country competitors must be prepared to offer the same terms. Recently Germany has been securing an increasing amount of the cotton-goods

trade in certain lines, particularly the finer grades of colored goods and linen fabrics. There are many Germans in the country and as there is a direct and quick steamship service between Bremen and Oporto, and the German manufacturers offer the same terms as the English, the competition in certain lines is growing very keen. In gray goods, however, England enjoys an almost complete monopoly, the imports from that country being chiefly print cloths. There is no fixed method of packing, but pieces of 126 yards are preferred in order to avoid so many seams in the bleaching and printing processes.

COMPETITION OF DOMESTIC MILLS—AMERICAN TRADE.

As in many other cotton-manufacturing countries of the world, Portugal supplies practically all the coarse goods for domestic consumption and the native mills are slowly securing a share of the business in finer grades. So firm is the hold that England has on this trade, however, that not infrequently the merchants use the mark "Ingles" on the products of the domestic mills.

It is rather difficult to ascertain the actual retail price of a piece of cotton goods in the stores in Portugal. One merchant will sell a cloth at 100 reis (10 cents) a meter, while another will offer the identical goods at 70 reis (7 cents), and sometimes the difference is even greater. Not infrequently the customer makes a lower offer than the price asked and it is accepted. There is a lack of uniformity in the methods of classification at the various customhouses, which results in different duties being levied on the same class of goods. This also leads to variations in prices on the same grade of goods.

American cotton goods are unknown in this market. One importer told me that he had used some American goods 10 to 15 years ago and that they were of a better quality than similar goods of English make. On being questioned as to why he had ceased to use them, he stated that the prices were too high and that his customers preferred the English goods at a lower figure. Another importer, on being asked why he did not use American goods, made the same complaint as to high prices, but stated that he had not seen quotations on American products in 10 years.

There seems to be a general impression that American goods are too high in price, and I believe that this could be dissipated, as there are undoubtedly certain lines of ginghams and print cloths that American firms could sell in Portugal in competition with other foreign manufacturers. There is certainly no prejudice against American goods; on the contrary, the importers and dealers seem to be extremely anxious to increase trade with the United States.

To secure a share of the cotton-goods business it is necessary not only to offer long terms of credit, but also to employ resident agents who are in close touch with the American exporter. Full and complete lines of samples should be given to the resident agent, with prices that would be good for one or two months. However, it is a question whether, under the most favorable conditions, the results of a serious effort to secure a share of the Portuguese cotton-goods trade would be satisfactory. The necessity of granting long terms of credit and the fact that at most the trade would be very small, make it seem extremely doubtful.

COTTON MANUFACTURING.

The cotton industry in Portugal comprises approximately 40 spinning and weaving mills, which contain a few more than 475,000 spindles, and 20,000 looms, and which employ about 50,000 operatives, of whom at least 75 per cent are women and girls. The annual consumption of cotton amounts to 60,000 bales, chiefly American, and the value of the product reaches \$20,000,000 per year. No official statistics of the cotton industry have ever been compiled; the foregoing figures were furnished by one of the leading manufacturers in the country.

Practically all of the mills are in the environs of Lisbon and Oporto, three-fourths of the total number of spindles being in and near the latter city. About one-half of the mills are incorporated companies (sociedade anonymas), while the remainder are private enterprises. Statistics of the former are not difficult to obtain, as the companies are required to publish annual balance sheets, but it is practically impossible to secure reliable information in regard to the mills operating privately. By those best informed on the subject, the total capital is estimated at \$15,000,000.

HIGH TARIFF ON COTTON GOODS.

Although cotton manufacturing is an old industry in Portugal, the business was given a great impetus in 1892 through the imposition of a high tariff on cotton goods, which is in force to-day. The duties are very high, as the following list, covering the grades of cotton goods most generally imported, will show. [Paper milreis=\$1 (fluctuating); kilo=2.2046 pounds].

Kinds of goods.	Import duties per pound.	Kinds of goods.	Import duties per pound.
Single cotton yarn:		Plain cloth weighing 5 to 12 kilos per 100 square meters—Continued.	
Nos. 1-40—		With 35 threads or more in each square centimeter—	
Bleached.....	\$0.082	Bleached.....	\$0.108
Unbleached.....	.068	Unbleached.....	.093
Nos. 61-100—		Bobbinet, fine net, and similar goods:	
Bleached.....	.136	Bleached or unbleached.....	.544
Unbleached.....	.113	Dyed or printed.....	.816
Plain cloth weighing 12 to 18 kilos per 100 square meters:		Nankeens, counterpanes, and moleskins:	
With 34 threads or less in each square centimeter—		Bleached or unbleached.....	.295
Bleached.....	.098	Dyed or printed.....	.408
Unbleached.....	.082	Bombazines and velveteens.....	.227
With 35 threads or more in each square centimeter—		Ticks, hollands, or drills:	
Bleached.....	.100	Bleached or unbleached.....	.091
Unbleached.....	.084	Dyed or printed.....	.372
Plain cloth weighing 5 to 12 kilos per 100 square meters:		Damasks and satens:	
With 34 threads or less in each square centimeter—		Bleached or unbleached.....	.204
Bleached.....	.106	Dyed or printed.....	.363
Unbleached.....	.088	Lace, insertions, and edging:	
		Bleached or unbleached.....	.816
		Dyed or printed.....	.907
		Shawls and handkerchiefs.....	.454
		Knit goods.....	.68

To reduce linear yards per pound to kilos per 100 meters the equation $K = \frac{1953}{YW}$ may be used, Y being the number of linear yards per pound, W the width of the cloth in inches, and K the weight in

kilos per 100 meters. For example, the weight in kilos per 100 meters of a standard print 28 inches wide and weighing 7 yards to the pound, would be $\frac{1953}{7 \times 28}$ or 9.964 kilos.

At the same time this tariff was enacted to apply to continental Portugal, the duties on cotton goods imported into the African colonies were fixed at 25 to 50 cents per kilo.. The significant point about this tariff, however, is the provision that Portuguese goods pay only 10 per cent of these duties, while other nations pay the full amount, unless the goods are transported in Portuguese ships, in which case they pay 80 per cent of the total duty.

EARNINGS OF COTTON FACTORIES—FLUCTUATIONS IN EXPORTS.

With the protection afforded by this tariff, the cotton industry had a healthy growth during the years 1893–1900. The earnings of the incorporated companies and the dividends declared during this period were:

Years.	Earnings.	Dividends.	Years.	Earnings.	Dividends.
	<i>Per cent.</i>	<i>Per cent.</i>		<i>Per cent.</i>	<i>Per cent.</i>
1893.....	7.14	4.67	1897.....	11.74	6.26
1894.....	9.46	5.15	1898.....	19.17	9.06
1895.....	14.29	6.71	1899.....	17.19	8.81
1896.....	11.27	6.48	1900.....	13.15	4.93

In 1900 the demand from Africa declined considerably, and the earnings for 1901 were only 0.33 per cent, increasing, however, to 3.72 per cent in 1902 and to 7.36 per cent in 1903. The exports of cotton goods, which in 1900 amounted to \$2,073,000, dropped to \$940,000 in 1901 and to \$690,000 in 1902. In 1903, however, the exports rose to \$1,627,000, and since then they have steadily increased, amounting to more than \$2,000,000 in 1909 and to \$1,322,556 during the first six months of 1910. The African demand for cotton goods is directly affected by the prices of rubber, cocoa, and coffee, which are the chief products of the colonies. Owing to the recent good prices for these articles and the consequent demand for goods, the cotton mills in Portugal are now (May, 1911) running on full time, and some of them are even working until 9 o'clock in the evening.

MILL BUILDINGS AND MACHINERY.

The cotton factories are built of concrete or stone, and are of the saw-tooth roof, one-story style. They are operated on the American rather than the English plan, and usually contain both spinning and weaving departments, carrying out all the processes from the raw cotton to the finished product. The machinery in the carding, spinning, and weaving sections is practically all of English manufacture, the principal makes being Platt Bros., Brooks & Doxey, Dobson & Barlow, and Howard & Bullough. The printing and finishing machinery is chiefly German.

The tariff on machinery is levied by weight, being 2 cents per kilo (2.2046 pounds) on machinery weighing 1,000 kilos or more, 3 cents per kilo when it weighs 500 to 1,000 kilos, and 4 cents on machinery weighing 100 to 500 kilos.

There are about 3,000 hand looms in Portugal and very few automatic looms. The cost of building and equipping a cotton mill in Portugal varies, of course, according to the class of goods to be manufactured and, to a certain extent, to the location of the plant. The average price for building and equipping a mill to make plain sheetings, from 18s to 20s yarn, is about \$17.50 per spindle, according to information obtained from several leading manufacturers and dealers in machinery for cotton mills. This price is from \$6 to \$8 lower than the amount usually estimated for building a similar mill in the United States, but it does not include any fire-protection equipment, sprinklers, or humidifiers.

Although all the coal is imported from England, steam is the motive power most generally used. Several rivers in the north could be utilized in the development of electric power, but it seems to be difficult to secure the capital with which to undertake it. However, one of the most up-to-date mills near Oporto is contemplating the installation of electric power developed from a near-by river. Coal costs from \$6 to \$8 per ton delivered, and the cost of power is from \$25 to \$30 per horsepower per year; some of the older mills with less modern and economical engines pay as high as \$40.

The cotton used in the mills is chiefly American, with small quantities of Egyptian and Brazilian for spinning the finer numbers of yarn. On account of the prevailing high prices asked for American cotton, some Indian is being imported and mixed with the former in the manufacture of the coarser grades of cloth. The price of American good middling cotton at this writing (May, 1911) landed at the mill is 41 cents per kilo (18.6 cents per pound).

The raw material is usually opened in the scutcher room, 10 to 15 bales being used in a mixing. The blower system, by which the cotton is opened in a separate room and blown through a pipe to the scutcher, is found in only a few mills. The cards are of the regulation type, 40 inches wide, with 110 to 120 flats. Two processes of drawing is the rule, with leather-covered top rolls on the frames. The spinning frames are the usual English style, with one leather-covered weighted front roll and two bare iron self-weighted back rolls. The frames are all long, running from 320 to 400 spindles each. There are very few mules, ring spinning being almost universal.

Looms are of the heavy English type with the overpick motion. Nearly all of the mills operate dobby looms, and a few of them are running Jacquards. The product is seldom confined to one grade or style of goods, and one mill that I visited was making plain sheetings, coarse plaids, towels, ticking, prints, and flannels. Some of the plants have very complete finishing departments, in which goods are bleached, dyed in the piece, and printed. The narrow colored goods that are exported to Africa are heavily starched. Some of the mills bleach, dye, and print for other factories, but this system is on the decline, owing to the fact that several separate finishing plants have been started recently.

WORKING HOURS AND WAGES.

There is no law regulating the hours of work or the age at which children may be employed. The number of hours varies, therefore, but the average is 11 daily, or 66 hours per week. Some of the mills stop at 9 a. m., allowing a half hour for breakfast, and an hour at noon for lunch, but the usual custom is to operate the mill from 6.30 a. m. to 6.30 p. m., giving one hour off at noon.

Wages are considerably lower than those paid in the United States, but from the standpoint of efficiency it is doubtful if the scale is so low as would appear on the surface, since two or three laborers are required to do the work usually performed by one in the United States. In the scutcher room the men are paid 36 cents per day, and four men are required to operate two breakers, three intermediates, and four finishers. Card hands are paid at the same rate as scutcher operatives, and in one mill visited six men were being used to run 46 cards. They were, however, required to do the stripping.

The predominance of women in all the departments beyond the card room is striking. Two women running 18 deliveries of drawings, back and front, are paid 30 cents per day each. The roving-frame tenders are paid by the hank, one operative running a single frame and earning from 30 to 35 cents per day. The wages in the spinning room vary widely. In one mill that I visited, near Lisbon, a girl who was running only one side of a spinning frame of 388 spindles was paid 30 cents a day, while in another mill near Oporto one girl was earning 18 cents per day for tending an entire frame of 332 spindles (the numbers of yarn being very nearly the same in each case). The average seems to be about 35 cents for running a whole frame, and the spinners are usually required to do the doffing.

Operatives on spoolers, twistors, and warpers earn from 36 to 40 cents per day. The weavers usually tend two looms (plain or dobby). The wages are altogether by the piece and the average earnings are from 30 to 40 cents per day.

EMPLOYERS' ORGANIZATIONS—LIVING CONDITIONS OF OPERATIVES.

There is no organization of the cotton operatives in Portugal, but there are two organizations of the employers, the Associação Industrial Portuguesa of Lisbon and the Associação Industrial Portuense of Oporto. About 80 per cent of the spindles in the country are represented in these two associations, which cooperate in all matters calculated to advance the interests of the cotton-manufacturing industry.

The laborers appear to be well contented and no trouble is experienced in securing all the operatives necessary to run the mills, because wages, on the average, are higher than those offered in agriculture or other lines of employment. Some difficulty is encountered, however, in the grape-gathering season, when there is a large demand for laborers, a condition of affairs to be compared with that which obtains among the mills in the Southern States during the cotton-picking period.

The housing conditions of the working classes in Portugal are rather poor, on the whole, but my observation was that the cotton-mill operatives are better housed and clothed than those engaged in other occupations. The dwellings are both one and two story, and some of them are owned by the mills and rented at the rate of 20 and 30 cents per room per week. The most progressive mills in the country set aside a certain sum from which the employees are paid one-half their regular wages when they are sick.

CLASS OF GOODS MANUFACTURED.

The Portuguese mills make a wide variety of fabrics, but the largest output is *paño cru*, a heavy sheeting or T cloth, usually counting 60 by 56 or 60 by 48 and weighing in the 25-inch width about 4 yards to the pound. The yarns used are numbers 14 to 18, and the goods are made in many widths, from 20 to 36 inches. The colored head ends woven in the ends of the pieces are dictated by the customer, but bright colors (yellow, green, and red) seem to predominate. [Samples showing many styles of head ends are filed in the Bureau of Manufactures.]

Next in importance among the products of the mills is a variety of coarse cotton plaids in narrow widths (24 to 28 inches), which are exported in large quantities to Africa. Other goods manufactured are calico, cotton flannels, dyed and printed ginghams, *patentes* (bleached sheetings), towels, and bedspreads.

Only a few of the mills spin fine yarns, but there are several small weaving mills (about 100 looms each) that are successfully making the finer grades of ginghams, madras, and shirtings from imported yarn, and the product compares favorably in weave and finish with similar goods imported from England.

The trade with Africa in prints is of considerable magnitude, but these goods are manufactured in Portugal to only a limited extent, the larger share of them coming from Manchester. The printing of these fabrics and their exportation to Africa is an industry of considerable importance and the native mills, in spite of the high tariff, do not seem able to compete successfully in their manufacture. The print cloths purchased from England for this purpose are of a variety of constructions and widths, but one of the most popular styles is a 28-inch 64 by 64 fabric weighing 7.4 yards to the pound and put up in pieces of 126 yards. One of the leading importers in Oporto stated that the current price of these goods was 20s. 4d. per piece, or 3.9 cents per yard, in Manchester, to which of course must be added the freight charges and duty, which amount to approximately 25 per cent.

There is also a demand for a wide print cloth, 52 and 59 inch. These goods are printed with all kinds of fantastic designs and cut up into lengths of 70 and 80 inches and are used in Africa to serve the purpose of a dress. They are very heavily starched and weigh from 11 to 12 ounces each. They are sold for 70 and 80 cents per "dress." [Samples on file in Bureau of Manufactures.]

PRINCIPAL MILLS IN PORTUGAL.

The following table gives the names of the principal mills in Portugal, their capital, and the number of spindles and looms:

Names of mills.	Capital.	Spindles.	Looms.
PROVINCE OF ESTREMADURA.			
Companhia da Fabrica de Fiação e Tecidos Lisbonense.....	\$800,000	17,500	600
Companhia da Fabrica de Fiação e Tecidos de Thomar.....	556,466	30,000	800
Companhia Oriental de Fiação e Tecidos.....	400,000	12,000	300
Companhia da Fabrica de Algodões de Xabregas.....	300,000	9,256	300
Sociedade Lisboa Industrial.....	300,000	9,080	300
Companhia Fabril Lisbonense.....	240,000	18,000	600
PROVINCE OF ENTRE DOURO E MINHO.			
Companhia Portuense.....	400,000	30,000	800
Companhia do Rio Ave.....	200,000	15,000	500
Companhia de Crestuma.....	300,000	20,000	600
Companhia d'Alcooba.....	300,000	20,000	650
Companhia do Porto.....	200,000	15,000	500
Companhia de Arcozello (weaving only).....	180,000	.....	230
Companhia de Salgueiros.....	375,000	30,000	900
Companhia de Fiação e Tecidos de Fafe.....	300,000	15,860	500
Companhia Fiação e Tecidos Guimarães.....	350,000	15,000	500
Fabrica do Jacintho.....	.....	30,000	900
Gulherme & Jose Graham & Ca.....	.....	30,000	1,000
Fabrica do Rio Vizella.....	.....	40,000	1,100
Fabril do Norte.....	.....	20,000	700
Coates & Clark (spinning only).....	.....	20,000	.....

The last five firms listed are private concerns located in Oporto, and the amount of their capital is not known.

COMPANHIA FABRIL LISBONENSE.

The Companhia Fabril Lisbonense operates three mills, two of which manufacture cotton goods and one woolen cloth, shawls, and blankets. The principal cotton mill is at Alhandra, 20 miles from Lisbon, and it is one of the best managed factories in Portugal. The mill is one story high and the saw-tooth roof provides excellent light. Power is furnished by an up-to-date 500-horsepower steam engine, the power plant being one of the most economical in Portugal. There are 12,000 spindles and 400 looms (32 to 54 inches wide), and 750 hands are employed, of whom 600 are females.

A wide range of cloths is manufactured, from plain sheetings and coarse plaids to a very fine grade of ginghams with dobby effects. In addition the company operates 50 jute looms on which bags and bur-lap are made.

The manager of this mill, a Portuguese, received his technical training in Manchester, and the plant is operated in a manner that compares favorably with the English and German mills. Practically all the labor is paid by the piece and the principles of scientific management are being applied. In the weave room a section man, or boss, oversees 50 looms and his wages are in proportion to the amount of cloth produced on his section each week. For each meter obtained over and above a certain fixed amount he is paid an additional sum, and the same method is used in paying the weavers, thus giving a premium to the more efficient operatives.

This company has prospered in recent years. Following is a statement of the results of the operation of the mill in 1910:

Items.	Amount.	Items.	Amount.
ASSETS.		LIABILITIES.	
Value of plant.....	\$705,950	Capital.....	\$240,000
Office furniture.....	1,375	Bonds.....	212,570
Cash on hand.....	11,764	Reserve.....	182,968
Bills and accounts receivable.....	89,885	Reserve for liquidating bonds.....	8,666
Raw cotton on hand.....	4,751	Reserve for aid to operatives.....	7,000
Stock in process and goods on hand.....	104,906	Interest on bonds.....	1,359
		Dividends unpaid.....	1,220
		Bills and accounts payable.....	216,281
		Profit and loss.....	48,627
Total.....	918,721	Total.....	918,721

FABRICA DE FIAÇÃO E TECIDOS DE FAFE.

The Fabrica de Fiação e Tecidos de Fafe is located at Fafe, about 30 miles from Oporto. Although it is one of the oldest mills in Portugal it is in splendid condition, new machinery having been added from time to time. The building is well lighted and ventilated and is equipped with a good system of humidifiers. To operate the 15,860 spindles and 500 looms 600 people are employed, of whom 450 are females. The machinery is all of English make, and yarn up to No. 60 (from Brazilian cotton) is spun. In addition to plain and dobby looms about 50 Jacquards are operated. The chief class of goods made is paño cru (plain heavy sheeting with colored head end), but an excellent quality of chambrays and shirtings is also woven here. The company operates a bleaching, dyeing, and finishing department.

The wages are perhaps lower than those existing anywhere else in the country, doubtless due to the fact that the mill is situated in a country district away from other industries, and the demand for labor is not very strong. The average wages throughout the mill are 30 cents per day, or from 5 to 10 per cent lower than the wages paid in the mills in the city of Oporto. The mill, so the manager informed me, has a large number of orders ahead and arrangements are being made to operate it until 9 o'clock at night.

FABRICA DO JACINTHO.

The Fabrica do Jacintho is considered one of the show mills of the country, and justly so. The factory is located in the city of Oporto, contains 900 looms and 30,000 spindles, and is owned by a private company. As in the other mills in Portugal, the output comprises a wide variety of cotton goods, including sheetings, print cloths, bleached goods, plaids, gingham, and flannels. The company operates a splendid printing plant consisting of three, four, and five color printing machines, which are in charge of a very skilled German. The flannels made and printed at this mill are of excellent quality in texture, nap, and printing, and I found them in great demand in the Oporto stores. The wages paid in this mill are somewhat higher than those which obtain in the country districts, and some of the weavers earn 50 to 75 cents per day, as compared with 30 and 40 cents paid for the same work in the mills outside the city.

OTHER TEXTILE INDUSTRIES.

Although cotton-cloth manufacturing is the leading industry in Portugal, knitted fabrics, woolen goods, linen, and silk are also produced for the home trade. There are 10 small knitting mills in the country making the cheaper grades of cotton hosiery and underwear. The knitting machines are German and French and the sewing machines are American. The industry is small and is not prospering, owing to the sharp competition among the domestic manufacturers.

Covilhão is the center of the woolen industry in Portugal. The town is situated in the eastern part of the Province of Beira, at the foot of the mountains, and is one of the oldest villages in the country, just as the manufacture of woolen goods is one of the oldest industries in Portugal. However, the mills have been slow to adopt new methods and the management has not been particularly efficient. The industry, therefore, is not growing very rapidly.

The native raw wool is used to some extent, but 2,958,429 pounds of wool (raw, combed, carded, and woolen rags) were imported during the six months ending June 30, 1909, and 3,242,359 pounds during the corresponding period in 1910. To these figures must be added the imports from Spain, which during the year 1909 amounted to 5,028,973 pounds. The fabrics produced by the woolen mills are medium and coarse grades of cloth for clothing, blankets, and shawls, the latter being used in large quantities by the peasants and poorer classes.

LINEN GOODS.

There are a number of looms in Portugal weaving linen goods, some of which are found in the cotton mills. There are, however, several mills for the exclusive manufacture of linen goods in the village of Torres Novas, between Lisbon and Oporto, and in Guimarães, near Oporto. The imports of flax and hemp during the six months ending June 30, 1910, were 1,569,400 pounds, as compared with 1,825,637 pounds during the corresponding period of 1909, while imports of linen yarn were 512,729 pounds and 565,181 pounds in 1909 and 1910, respectively. The products of the linen mills are of excellent quality as regards both weave and finish. The goods manufactured comprise linen piece goods, towels, handkerchiefs, and tablecloths, and the native mills supply about 80 per cent of the domestic demand for these articles.

LISTS OF SAMPLES.

Accompanying the foregoing reports were numerous samples of goods, which have been filed in the Bureau of Manufactures and which will be loaned, upon application, to interested persons and firms. The following lists give a brief description of the various samples:

SPAIN.

Sample 1.—Corduroy made in Spain; width, 26½ inches; weight, 10.58 ounces per yard; retail price per meter, 2.40 pesetas (43 cents); made with 2 by 2 twill or Genoa back.

Sample 2.—Corduroy made in Spain; width, 26½ inches; weight, 10.58 ounces per yard; retail price per meter, 2.40 pesetas (43 cents); made with 2 by 2 twill or Genoa back.

Sample 3.—Corduroy made in Spain; width, 26½ inches; weight, 10.58 ounces per yard; retail price per meter, 2.75 pesetas (49.28 cents); made with 2 by 2 twill or Genoa back.

Sample 4.—Cotton velvet made in Spain; width, 25½ inches; weight, 8.81 ounces per yard; retail price per meter, 2.45 pesetas (43.9 cents); made with 2 by 2 twill or Genoa back.

Sample 5.—Cotton velvet made in Spain; width, 25½ inches; weight, 8.81 ounces per yard; retail price per meter, 2.45 pesetas (43.9 cents); made with 2 by 2 twill or Genoa back.

Sample 6.—Cotton velvet made in Spain; width, 25½ inches; weight, 8.81 ounces per yard; retail price per meter, 2.30 pesetas (41.21 cents); made with 2 by 2 twill or Genoa back.

Sample 7.—Biarritz fantasia, a mercerized dobby fine cheviot made in Spain; width, 68 centimeters (26.77 inches); 23 warp and 12 filling threads per 6 millimeters square; weight, 23.80 kilos per 100 square meters, or 3.05 yards per pound; wholesale price, 1.43 pesetas (25.73 cents) per meter less 10 per cent and 2 per cent discount; packed 30 pieces to the case, each piece about 33 meters; packing charges 10 pesetas (\$1.79) per case. These goods are sold in the Philippine Islands.

Sample 8.—Crudillo corona, a linen fabric made in Spain and exported to the Philippine Islands; width, 65 centimeters (25.59 inches); 13 warp and 11 filling threads per 6 millimeters square; weight, 3.75 yards per pound; price, 60 centimos (10.75 cents) per meter; packed 50 pieces to the case, 30 yards to the piece; discount, 10 per cent and 2 per cent; packing charges, 10 pesetas (\$1.79) per case.

Sample 9.—Crudillo Gallo, linen goods made in Spain and exported to the Philippine Islands; width, 65 centimeters (25.59 inches); weight, 23.8 kilos per 100 square meters, or 3.2 yards per pound; 13 warp and 11 filling threads per 6 millimeters square; price per meter, 62½ centimos (11.2 cents); packed 50 pieces to the case, 30 yards to the piece; packing charges, 10 pesetas (\$1.79) per case.

Sample 10.—Vichy, the name given to fine gingham; made in Spain for both the home market and exportation; sample is 31 inches wide, 98 by 76 threads per inch; weight, 6.06 yards per pound; retail price per meter, 1.25 pesetas (22.4 cents).

Sample 11.—Vichy; another pattern of No. 10.

Sample 12.—Vichy; another pattern of No. 10.

Sample 13.—Vichy; another pattern of No. 10.

Sample 14.—Batiste made in Spain in competition with foreign goods; sample is a printed pattern; width, 80 centimeters (31.2 inches); 104 by 88 threads per inch; weight, 7.35 yards per pound; retail price per meter, 1.25 pesetas (22.4 cents).

Sample 15.—Batiste; another pattern of No. 14.

Sample 16.—Drill, not to be confused with English drills, which are goods with a twill weave; Spanish drill may be either plain woven, as is generally the case, or

twilled; sample is made of 2-ply mercerized filling and 2-ply plain black cotton warp (filling is white); width, 71 centimeters (27.51 inches); weight, 4.12 yards per pound; 96 by 68 threads per inch; retail price per meter, 2.75 pesetas (49.28 cents).

Sample 17.—Dril; another pattern of No. 16, the construction and price being the same.

Sample 18.—Dril; another pattern of No. 16, the construction and price being the same.

Sample 19.—Another class of dril made in Spain and one of the most popular styles; worn altogether by the street-car conductors and by many other workmen; width, 71 to 72 centimeters (27.51 to 28.29 inches); weight, 4 yards per pound; 128 2-ply warp (pattern, 2 white ends, 2 black ends) plain cotton threads and 72 2-ply black filling threads per inch; sometimes made with mercerized filling and sometimes mercerized in the piece after being woven; retail price per meter, 2.50 pesetas (44.8 cents).

Sample 20.—Dril; width, 67 centimeters (26.3 inches); 92 by 80 threads per inch; 4.8 yards per pound; retail price per meter, 2 pesetas (35.84 cents).

Sample 21.—Dril; width, 67 centimeters (26.3 inches); 56 by 44 threads per inch; drawn in two in an eye, two shots of filling to each pick; warp pattern 2 black ends, 2 white ends; filling all black; weight, 4.12 yards per pound; retail price per meter, 2.75 pesetas (49.28 cents).

Sample 22.—Dril; width, 66 centimeters (25.93 inches); weight, 2.93 yards per pound; 92 by 40 picks per inch; warp, 2-ply; filling cord; retail price per meter, 1.50 pesetas (26.88 cents).

Sample 23.—Dril; width, 70 centimeters (27.3 inches); warp and filling 3-ply; 56 by 36 picks per inch; weight, 2.5 yards per pound; retail price per meter, 3.75 pesetas (67.2 cents).

Sample 24.—White shirting, made of cotton and linen mixed; sold to the Porto Rico trade; width, 85 centimeters (33.4 inches); 56 by 60 threads per inch; weight, 3.88 yards per pound; manufacturer's price per meter, 75 centimos (13.44 cents).

Sample 25.—White shirting, made of cotton and linen; width, 80 centimeters (31.44 inches); 56 by 60 threads per inch; weight, 4.12 yards per pound; manufacturer's price per meter, 75 centimos (13.44 cents).

Sample 26.—Holanda, made of linen; exported to Porto Rico; width, 86 centimeters (33.79 inches); 56 by 60 threads per inch; weight, 3.88 yards per pound; manufacturer's price per meter, 95 centimos (17.02 cents).

Sample 27.—Holanda, made of linen; exported to Porto Rico; width, 86 centimeters (33.79 inches); 56 by 60 picks per inch; weight, 3.36 yards per pound; price per meter, 1.05 pesetas (18.81 cents).

Sample 28.—Holanda, made of linen; exported to Porto Rico; width, 86 centimeters (33.79 inches); 72 by 56 picks per inch; weight, 3.1 yards per pound; price per meter, 1.05 pesetas (18.81 cents).

Sample 29.—Holanda, made of linen; exported to Porto Rico; width, 86 centimeters (33.79 inches); 68 by 60 picks per inch; weight, 4.12 yards per pound; manufacturer's price per meter, 1.10 pesetas (19.71 cents).

Sample 30.—Holanda, made of linen; exported to Porto Rico; width, 86 centimeters (33.79 inches); 68 by 56 picks per inch; weight, 3.5 yards per pound; price per meter, 1.15 pesetas (20.6 cents).

Sample 31.—Holanda, made of linen; exported to Porto Rico; width, 80 centimeters (31.4 inches); 80 by 72 picks per inch; weight, 3.54 yards per pound; manufacturer's price per meter, 1.30 pesetas (23.19 cents).

Sample 32.—Holanda, made of linen; exported to Porto Rico; width, 86 centimeters (33.79 inches); 80 by 72 picks per inch; weight, 4.12 yards per pound; manufacturer's price per meter, 1.40 pesetas (24.08 cents).

Sample 33.—Holanda, made of linen; exported to Porto Rico; width, 86 centimeters (33.79 inches); 92 by 80 picks per inch; weight, 4.12 yards per pound; manufacturer's price per meter, 1.65 pesetas (29.56 cents).

Sample 34.—Holanda, made of linen; exported to Porto Rico; width, 86 centimeters (33.79 inches); 96 by 96 picks per inch; weight, 4.12 yards per pound; manufacturer's price per meter, 2 pesetas (35.84 cents).

Sample 35.—Holanda, made of linen; exported to Porto Rico; width, 86 centimeters (33.79 inches); 96 by 96 picks per inch; weight, 4.5 yards per pound; manufacturer's price per meter, 2.80 pesetas (50.17 cents).

Sample 36.—White bleached shirting made in Spain; width, 160 centimeters (62.88 inches); 60 by 48 picks per inch; price per meter, 87½ centimos (15.23 cents).

Sample 37.—White bleached shirting made in Spain; width, 83 centimeters (32.61 inches); 90 by 96 picks per inch; price per meter, 60 centimos (10.75 cents).

Sample 38.—White bleached shirting made in Spain; width, 83 centimeters (32.61 inches); 96 by 84 picks per inch; price per meter, 75 centimos (13.44 cents).

Sample 39.—White bleached shirting made in Spain; width, 83 centimeters (32.61 inches); 90 by 84 picks per inch; price per meter, 65 centimos (11.64 cents).

Sample 40.—Cotton undershirt; sold in large quantities in the Philippine Islands; price per dozen, 17.50 pesetas (\$3.13).

Sample 41.—Cotton undershirt; sold largely in the Philippines; price per dozen, 14 pesetas (\$2.50).

Sample 42.—Dril Manila; width, 70 centimeters (27.5 inches); 90 by 56 picks per inch; 2-ply yarn; weight, 0.26 pound per square yard; price per meter, 1.30 pesetas (23.2 cents), less 6 per cent discount.

Sample 43.—Dril Japonese; width, 67 centimeters (26.33 inches); 87 by 52 picks per inch; 2-ply yarn; weight, 0.39 pound per square yard; price per meter, 1.20 pesetas (21.4 cents), less 6 per cent discount.

Sample 44.—Dril holanda; width, 29½ inches; 76 by 76 picks per inch; weight, 4.5 yards per pound; price per meter, 0.95 peseta (17 cents), less 6 per cent discount.

Sample 45.—Alpaca; width, 26½ inches; weight, 3.55 yards per pound; price per meter, 0.90 peseta (16.12 cents).

Sample 46.—Alpaca; width, 26½ inches; weight, 4 yards per pound; price per meter, 1.125 pesetas (20.16 cents).

Sample 47.—Semialpaca; width, 26½ inches; weight, 3.55 yards per pound; price per meter, 0.80 peseta (14.33 cents).

Sample 48.—Alpaca; width, 26½ inches; weight, 3.75 yards per pound; price per meter, 1.25 pesetas (22.48 cents).

Sample 49.—Dril; width, 28½ inches; weight, 2.41 yards per pound; price per meter, 0.95 peseta (17.02 cents).

Sample 50.—Dril; width, 27 inches; weight, 4 yards per pound; price per meter, 0.86125 peseta (15.4 cents).

Sample 51.—Dril; width, 26½ inches; weight, 3.36 yards per pound; price per meter, 0.9375 peseta (16.78 cents).

Sample 52.—Dril; width, 27½ inches; weight, 2.75 yards per pound; price per meter, 1.025 pesetas (18.36 cents).

Sample 53.—Dril; width, 26½ inches; weight, 2.9 yards per pound; price per meter, 1.15 pesetas (20.6 cents).

Sample 54.—Dril; sold in Argentina; width, 27½ inches; weight, 2.75 yards per pound; price per meter, 1.065 pesetas (18.98 cents).

Sample 55.—Dril; width, 26½ inches; weight, 2.73 yards per pound; price per meter, 1.175 pesetas (20.95 cents).

Sample 56.—Gingham; width, 27½ inches; weight, 7.25 yards per pound; price per meter, 0.41 peseta (7.34 cents).

Sample 57.—Gingham; width, 27½ inches; weight, 5 yards per pound; price per meter, 0.40 peseta (7.16 cents).

Sample 58.—Gingham; width, 27½ inches; weight, 4.5 yards per pound; price per meter, 0.40 peseta (7.16 cents).

Sample 59.—Sheeting; width, 88 centimeters (34.58 inches); 52 by 60 threads per inch; weight, 4.95 yards per pound; price per meter, 1.40 reals (6.72 cents).

Sample 60.—Sheeting; width, 88 centimeters (34.58 inches); 52 by 52 picks per inch. In the following weights and prices: 12 kilos per 100 meters, 7.43 cents per meter; 14½ kilos, 8.4 cents; 16½ kilos, 8.9 cents; 17½ kilos, 9.9 cents; 20 kilos, 11 cents; 22 kilos, 11.35 cents; 23 kilos, 12.2 cents.

Sample 61.—Sheeting; width, 88 centimeters (34.58 inches); 52 by 52 picks; weight, 5.1 yards per pound; price per meter, 5.5 cents.

Sample 62.—Victoria lawn, imported from England; weight, 60 grams (2.116 ounces) per yard; retail price per meter, 1.25 pesetas (22.4 cents).

Sample 63.—Dril; retail price per meter, 1.25 pesetas (22.4 cents).

Sample 64.—Dril; retail price per meter, 1.25 pesetas (22.4 cents).

Sample 65.—Dril; retail price per meter, 1.25 pesetas (22.4 cents).

Sample 66.—Dril; retail price per meter, 1.75 pesetas (31.36 cents).

Sample 67.—Dril; width, 25 inches; weight, 3.55 yards per pound; price per meter, 0.825 peseta (14.77 cents).

Sample 68.—Cheap cotton socks.

Three invoices of cloth shipped to the United States, with samples attached.

Six-inch paper bobbin used in Spain.

Thirty-seven photographs of factory buildings and machinery, operatives' dwellings, etc.

PORTUGAL.

Sample 1.—Print cloth, imported from England; width, 36 inches; picks per inch, 76 by 76; yards per pound, 4.42; length of piece, 75 yards; price per piece (in England), 18s. 7d.; price per yard, 6 cents.

Sample 2.—Print cloth, imported from England, width, 32 inches; picks per inch, 76 by 80; yards per pound, 3.62; length of piece, 76 yards; price per piece, 21s. 11d.; price per yard, 7.1 cents.

Sample 3.—Print cloth, imported from England; width, 34 inches; picks per inch, 72 by 80; yards per pound, 4.43; length of piece, 75 yards; price per piece, 19s. 2d.; price per yard, 6.21 cents.

Sample 4.—Print cloth, imported from England; width, 36 inches; picks per inch, 72 by 84; yards per pound, 4.17; length of piece, 76 yards; price per piece, 20s. 2d.; price per yard, 6.44 cents.

Sample 5.—Print cloth, imported from England; width, 34 inches; picks per inch, 72 by 88; yards per pound, 5.3; length of piece, 76 yards; price per piece, 19s. 10d.; price per yard, 6.34 cents.

Sample 6.—Print cloth, imported from England; width, 38 inches; picks per inch, 76 by 88; yards per pound, 3.87; length of piece, 75 yards; price per piece, 21s. 9d.; price per yard, 7.05 cents.

Sample 7.—Print cloth, imported from England; width, 36 inches; picks per inch, 80 by 76; yards per pound, 3.9; length of piece, 76 yards; price per piece, 22s. 2d.; price per yard, 7.1 cents.

Sample 8.—Print cloth, imported from England; width, 29 inches; picks per inch, 64 by 64; yards per pound, 7.4; length of piece, 126 yards; price per piece, 20s. 4d.; price per yard, 3.9 cents.

Sample 9.—Print cloth, imported from England; width, 36 inches; picks per inch, 80 by 72; yards per pound, 5.69; length of piece, 76 yards; price per piece, 17s. 6d.; price per yard, 5.6 cents.

Sample 10.—Paño cru (plain sheeting), made in Portugal; width, 25 inches; picks per inch, 56 by 48; yards per pound, 4.12; retail price per yard, 9.16 cents.

Sample 11.—Paño cru (plain sheeting), made in Portugal; width, 24 inches; picks per inch, 60 by 56; yards per pound, 4.66; price per yard, 7.33 cents.

Sample 12.—Paño cru (plain sheeting), made in Portugal; width, 59 inches; picks per inch, 60 by 48; yards per pound, 1.29; price per yard, 20.5 cents.

Sample 13.—Printed sheet for dresses in the African colonies; imported from England and printed in Portugal; width, 52 inches; size of each dress, 52 by 70 inches; weight of each dress, 15 ounces; price of each, 80 cents; picks per inch, 54 by 56.

Sample 14.—Same as No. 13, except width is 39 inches; size of each dress, 39 by 80 inches; weight of each, 11.75 ounces; price, 70 cents; picks per inch, 48 by 44.

Sample 15.—Same as No. 13, except width is 50 inches; size of each dress, 50 by 70 inches; weight of each dress, 11 ounces; price of each, 70 cents; picks per inch, 60 by 44.

Sample 16.—Gingham, made in Portugal; width, 23.6 inches; picks per inch, 56 by 48; yards per pound, 5.9; price per yard, 7.75 cents; 40 to 50 yards per piece.

Sample 17.—Gingham, made in Portugal; width, 25.75 inches; picks per inch, 52 by 52; yards per pound, 4.85; price per yard, 12.5 cents; 40 to 50 yards per piece.

Sample 18.—Gingham, made in Portugal; width, 25.35 inches; picks per inch, 54 by 46; yards per pound, 6.08; price per yard, 9.6 cents; 40 to 50 yards per piece.

Sample 19.—Gingham, made in Portugal; width, 23.6 inches; picks per inch, 56 by 48; yards per pound, 6.25; price per yard, 9.25 cents; 40 to 50 yards per piece.

Sample 20.—Fine zephyr, imported from England; width, 32 inches; picks per inch, 116 by 80; yards per pound, 6.06; retail price per yard, 33 cents; put up double fold, 40 yards per piece.

Sample 21.—Fine zephyr, imported from England; width, 32 inches; picks per inch, 80 by 72; yards per pound, 6.04; retail price per yard, 33 cents; put up double fold, 40 yards per piece.

Sample 22.—Fine white shirting, imported from England; width, 32 inches; picks per inch, 110 by 84; yards per pound, 5.67; retail price per yard, 36 cents; put up double fold, 40 yards per piece.

Sample 23.—Printed flannel (cotton), made in Portugal; width, 28½ inches; picks per inch, 50 by 40; yards per pound, 4.12; price per yard, 20 cents.

Sample 24.—Printed cotton flannel, made in Portugal; width, 28 inches; picks per inch, 50 by 40; yards per pound, 4.12; price per yard, 20 cents.

Sample 25.—Printed cotton flannel, made in Portugal; width, 26 inches; picks per inch, 52 by 44; yards per pound, 3.36; price per yard, 23 cents.

Sample 26.—Printed calico, imported from England and printed in Portugal; width, 28 inches; picks per inch, 72 by 72; yards per pound, 4.12; retail price per yard, 14 cents.

Sample 27.—Gray goods for handkerchiefs, imported from England; woven with a border on all sides; made 37 inches wide and split; each piece of 36 yards makes 12 dozen handkerchiefs 18 by 18 inches; goods have 114 by 124 picks, weigh 8 yards per pound, and are sold for 15.5 cents per yard.

Sample 28.—Same kind of goods as No. 27, except 45 inches wide and with colored border all around; woven 45 inches wide and split; each piece of 44 yards makes 12 dozen handkerchiefs, 22 by 22 inches; price per piece, 26s.; picks per inch, 96 by 96; yards per pound, 6.96; price per yard, 14.35 cents.

Sample 29.—Gingham, made in Portugal; width, 27.3 inches; picks per inch, 56 by 48; yards per pound, 5.28; price per yard, 10.5 cents.

Sample 30.—Gray twill, imported from England; width, 40 inches; picks per inch, 72 by 96; yards per pound, 4.05; yards per piece, 100; price per yard, 7.5 cents.

Sample 31.—Patente (bleached sheeting), made in Portugal; width, 32 inches; picks, 72 by 64; yards per pound, 4.5; retail price per yard, 14 cents.

Sample 32.—Lorna forte (heavy duck), made in Portugal; width, 28½ inches; picks per inch, 48/2 by 36; yards per pound, 2.48; price per yard, 16.5 cents.

Sample 33.—Linen towel, made in Portugal; size, 55 by 26½ inches; weight per dozen, 4.8 pounds; price per dozen, \$9.60.

Sample 34.—Turkish towel, made in Portugal; size, 50 by 24 inches; weight per dozen, 9½ pounds; price per dozen, \$6.60.

Sample 35.—Turkish towel made in Portugal; size, 40 by 22 inches; weight per dozen, 5½ pounds; price per dozen, \$3.03.

Sample 36.—Pafio cru (sheeting) showing styles of colored head ends.

Five photographs of factory and equipment.



DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 47

ENGLISH COTTON-GOODS TRADE

By

J. M. HAUSE

Commercial Agent of the Department of Commerce and Labor

TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD



WASHINGTON
GOVERNMENT PRINTING OFFICE

1911

LETTER OF TRANSMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
OFFICE OF THE SECRETARY,
Washington, December 4, 1911.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1912, approved March 4, 1911, a report by Commercial Agent J. M. Hause, of this department, containing the results of investigations of the cotton-goods trade in England.

Respectfully,

BEN. S. CABLE, *Acting Secretary.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, October 7, 1911.

SIR: I have the honor to submit herewith a report by Commercial Agent J. M. Hause, which describes some of the factors contributing to the success of the English cotton-manufacturing industry, and presents statistics showing the trend of the English trade during recent years.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

To Hon. CHARLES NAGEL,
Secretary of Commerce and Labor.

ENGLISH COTTON-GOODS TRADE.

The phenomenal success of hundreds of small cotton mills in England may be largely attributed to low capitalization as well as to scientific management.

The system of renting room and power is a common one. An experienced manufacturer with limited funds in this way finds an opportunity for manufacturing cottons, and is as well equipped as in the American mill of the same size with several times as much capital.

Erecting buildings and equipping them with power has proved, after years of experience, a safe investment. A landowner with idle money will readily erect and equip the desired buildings for a limited company or individual in preference to buying stock in mills. The customary rental based on 45s. (\$10.95) per loom and £100 (\$486.65) per slasher, per annum, insures to the owner of the structure a fair return on the investment, and is less expensive to the manufacturer than owning the buildings and power, especially if operating on limited means. This method is more generally practiced in weaving than in any other process of manufacturing, although numerous spinning mills are operated under this plan.

DETAILS OF MANAGEMENT AND COST.

The owner of buildings and power guarantees facilities to operate any given number of looms 60 hours a week with a speed of 220 picks per minute.

The manufacturer employs a manager (the only salaried man in the plant), who, having a wide acquaintance among mill operatives, employs for a 1,000-loom plant, 15 overseers, agreeing to give each a certain percentage of the earnings of each weaver under his charge. The overseer in turn employs experienced weavers for the plant, say 250 men and women, with an average of 4 looms to the weaver.

Suppose it is decided to make one of the standard print cloths, 32 inches wide, 64 by 64, using 38s warp and 44s filling. According to the standard wage schedule the "weaving wage" or price to be paid weavers would be 66 cents per piece of 116 trade or "long stick" yards of 36½ inches each. This construction requires per piece 7.83 pounds warp and 7.2 pounds filling, allowing 5 per cent for waste. He goes to the yarn merchant, who in July, 1911, would have charged him 24 cents a pound for 38s warp and 23 cents a pound for 44s filling. All other expenses—above yarn, waste, space and power rental, and weaving wage—including manager's salary, wages of overseers, and general help, supplies, repairs, etc., work out at five-eighths of the weaving wage.

The goods being practically ready for market the manufacturer goes to the "goods agent" who effects the sale. This is frequently done even before the mill is started or the yarns purchased. In this way it is known exactly what each piece or pound of goods will cost, and how much profit is being made each working day.

Such a system eliminates two-thirds of the average American mill cost in the way of operatives' houses, plants, grounds, etc., therefore less gross profits are necessary to pay dividends.

COOPERATION OF LABOR—MILL COMBINATIONS.

In or near towns where such a plant is operated live several thousand working people who find employment in various plants of a similar nature residing in houses owned by entirely different people, the means and methods of renting being of no concern to the operator.

Such a system necessitates very little working capital, as the manufacturer can deliver his goods in Manchester and receive payment the following day by discounting his invoice 4 per cent. Or he may sell his goods direct to the shipper and receive payment in 10 days from the date of invoice, less 2½ per cent. The operatives, working under a scale of uniform wages agreed upon by the weavers' union and mill owners, have little or no desire to move about—as is the case with the American mill operative—and therefore spends many years in the employ of one mill.

The larger production, of course, shows the better marginal profit. The owner is assured of his profit because his overseers' income is based on the weavers' earnings. Therefore, employer and overseers work hand in hand to see that each loom runs 220 picks per minute of the working day and the full capacity of the loom is obtained. It is seldom necessary for the owner or manager to criticize the overseer for lack of production in his department, the overseer and the weaver being vitally interested in every machine doing its best. Such a system can hardly be improved upon and leaves little ground for speculation.

There is a tendency of late years to concentrate interests—notwithstanding the success attained by small mills—by grouping a number of small concerns under one management, rather than building large individual plants, which seems most profitable under local conditions. In this respect the Fine Cotton Spinners' Association leads the British Empire with 100 mills, having in the aggregate 4,000,000 spindles. Horrockses, Crewdson & Co., of Preston, with 7,500 looms and 250,000 spindles, is the largest single firm of cotton manufacturers in England.

ADVANTAGES OF CONCENTRATION.

Cheap skilled labor and atmospheric conditions play important parts in the low cost of Lancashire textile production. Old men who have spent their lives at the loom, following fathers before them, may be seen at work in the mills with their sons and grandsons. With such experience and with the technical training now being given, the English mill operative of to-day tends naturally to a higher degree of efficiency than is to be expected from the farm hand fresh from the fields as found in many American mills.

The concentration of industries engaged in the various parts of the process of manufacturing of cotton, cotton-mill machinery, and requisites facilitates this great English industry. A world-wide market at the door where a day's production may be sold for net cash; where any number of pieces of goods may be finished to order; where materials, from raw cotton to the smallest part of a machine, may be had on an hour's notice, all go to make up a system that has required many generations to perfect.

It has been stated that to some extent the Lancashire manufacturing industry does not keep up to date in equipment. It is true to-day that some mills hoist a bale of cotton from a dray to the opening room on the top floor by a hand pulley, and say they do it because their grandfathers did it, but most of them unload it by an electrical apparatus because it pays.

CAUSES OF SUCCESS—HANDLING EXPORT ORDERS.

A hundred well-posted manufacturers, on being asked for their ideas of the secrets of success in the trade, will give many different reasons, each one having its peculiar bearing on the ultimate result. In the matter of cotton manufacturing, geographical and atmospheric conditions, cheap skilled labor, specialization, and low interest rates play important parts; of these, England's wonderful banking system is possibly the most important factor in the extension of the country's export trade.

With the financial assistance, small mills are enabled to accept business on forward shipments and long datings that American manufacturers would not consider. Frequently small orders in which there is good profit are booked by the shipper for a house in China or India for the delivery of so many cases per month, covering a period of 6 to 10 months, which trade would not interest American mills.

The order may specify 10 cases each month for 10 months and the manufacturer or agent ships the entire order at once, discounts the documents, and uses the proceeds for additional business.

The manufacturer or agent's bank, which is a branch of a London institution having a branch bank, say, at Shanghai or Hongkong, forwards the bill of lading with a copy of the order to the London bank for credit, which in turn forwards the documents to the bank in China with advice that these goods will be stored on arrival in certain bonded warehouses, and that they will receive on a specified date properly numbered receipts to deliver the designated 10 cases to the proper parties who surrender the receipt. The procedure is repeated by the branch bank in China each month on payment of the invoice installment until the order is completed. In this manner the consignor and bank are protected, with the goods in storage as collateral. Freights, insurance, storage, and interests being a matter of calculation, are included in the price.

The Chinese jobber and retailer are thus enabled to carry smaller stocks than if they contended with the uncertainty of deliveries incurred by great distances.

NATURAL ADVANTAGES.

The natural advantages of Lancashire for cotton manufacturing constitute the determining factor in its location and success. Cheap labor and coal, humid atmosphere, the port and proximity of subsidiary industries, might be mentioned as the principal ones.

The damp climate, while entirely unsuited for agriculture and outdoor occupations, is especially suited to cotton manufacturing; the damp breezes from the Atlantic driven inland deposit moisture that is essential and is unobtainable in mechanical humidifiers.

Auxiliary industries dependent upon the main industry have prospered accordingly. Practically all of the machinery used in British

cotton manufacturing is made in Lancashire, and the adaptation of means to an end in this respect is noticeable. The export trade, due largely to waterway facilities and aided by the English banking system, has expanded wonderfully.

SPECIALIZATION—CONFORMITY TO BUYERS' WANTS.

The cotton industry of Great Britain is more highly differentiated than that of any other country, not alone in variety of productions, but the various branches are specialized to a degree unknown elsewhere. Spinning, weaving, printing, bleaching, dyeing, mercerizing, finishing, and packing are all distinct businesses, conducted by methods calculated to produce maximum quantities of the best quality at a minimum cost.

Taking a broad survey of existing conditions in Lancashire as compared with the United States, the opinion is ventured that, notwithstanding the favorable climate, well-trained operatives, and numerous other advantages of the former, they may be overcome by adjusting the American industry to the needs of the trade, export and domestic, rather than by an endeavor to train prospective customers in buying goods in weights, widths, and size packages that best suit the convenience of the factory.

If there is not a profit in manufacturing a plain 68 by 70 six-yard goods or a 28-inch 64 by 60 $7\frac{1}{4}$ -yard goods with 10 per cent sizing, and the trade wants the same widths, but fewer yards to the pound, with heavier sizing and smaller bales, it surely is more profitable to manufacture what the trade wants than to educate it to the economy of buying what we think it should have.

Two striking examples of this point have recently been brought to the notice of the writer. One developed from a conversation with a foreign representative of an English firm, who said he had just returned from a trip on which he had secured business for an inferior fabric—that is, more heavily sized—in competition with American goods at the same prices, on account of his willingness to pack the bales with fewer pieces than was the custom of the American firm.

The other instance is based on the experience of a millman from the Southern States, who manufactured a heavy fabric for which he stated he had not had an order from London in several years. While in that city on a pleasure trip he decided to inquire of the trade what demand there was for his goods. Several dealers stated that they had never heard of his goods (although he is the largest manufacturer of that particular fabric in the world), and ordered a small quantity for trial. This millman stated that with the proper representation he thought as many, if not more, of his goods could be sold in London in a year than in any city of the United States, upon which he now depends almost exclusively for the sale of his output.

In one case it will be noted that American cotton manufacturers are not inclined to make and pack what the trade wants and, in the other, that they are not seeking thoroughly to find a market for what they are in position to produce.

WEAVERS HAVE PRESENT ADVANTAGE OVER SPINNERS.

Lancashire, like America, has suffered during the recent depression, some branches more than others. Spinners having been running for several months on very small margins of profits, and in some instances at a loss, but the weaving branch has had the benefit of it.

Manufacturers, as weavers are designated in England, have profited by the overproduction of yarns, which condition has been brought about by the building of so many more spindles than looms during the flourishing times a few years ago. However, each and every branch of the trade is working with renewed energy to keep the cost of production below the prices obtainable and, with few exceptions, is succeeding.

FOREIGN TRADE SHOWS FURTHER GAINS.

The exportation of cotton piece goods from the United Kingdom attained a new high record in the first six months of this year, both in quantity and value. The following table shows the exports to various countries during the half year compared with the January 1 to June 30 periods of 1910 and 1911, the total value appearing at the bottom:

Country or port.	1909	1910	1911
	<i>Yards.</i>	<i>Yards.</i>	<i>Yards.</i>
Denmark.....	11,153,900	9,849,600	11,823,700
Germany.....	35,033,800	45,292,500	46,303,000
Netherlands.....	31,653,000	28,580,900	29,459,200
Belgium.....	21,513,500	26,519,200	19,331,500
France.....	5,181,600	7,150,700	5,572,300
Switzerland.....	28,353,900	36,647,900	43,894,900
Portugal, Azores, and Madeira.....	11,394,500	22,099,600	19,614,500
Italy.....	8,320,300	8,666,400	8,461,900
Greece.....	13,016,600	12,717,100	12,929,100
Roumania.....	20,331,800	20,206,900	24,477,300
Turkey.....	212,041,900	185,984,700	234,657,700
Egypt.....	120,412,900	115,762,500	162,258,800
Morocco.....	28,259,900	22,358,100	23,904,600
Foreign West Africa.....	24,359,600	41,798,700	42,665,100
Persia.....	14,374,500	22,557,300	18,311,800
Dutch East Indies.....	113,951,800	88,899,500	130,700,300
Philippine Islands and Guam.....	17,638,600	15,705,500	11,829,900
Siam.....	6,182,000	6,773,200	9,954,600
China (including Hongkong).....	332,550,800	223,030,300	347,586,000
Japan.....	53,763,000	62,294,200	80,872,500
United States.....	38,458,700	33,415,400	32,226,500
Cuba.....	36,901,200	32,047,700	28,609,400
Haiti and Dominican Republic.....	5,700,600	4,711,200	5,710,100
Mexico.....	7,557,900	9,791,000	10,166,000
Central America.....	19,271,100	16,248,900	27,696,900
Colombia and Panama.....	24,719,400	28,003,500	26,391,200
Venezuela.....	13,547,900	21,500,900	34,987,200
Peru.....	12,474,700	14,702,900	13,401,500
Chile.....	29,692,800	44,180,700	38,711,700
Brazil.....	37,034,900	58,450,300	74,763,300
Uruguay.....	13,398,500	20,584,600	19,818,800
Argentina.....	88,370,000	100,218,300	97,296,800
British West Africa.....	39,214,100	54,851,500	53,419,200
British South Africa.....	30,608,700	37,479,400	37,932,100
British India, via:			
Bombay via Karachi.....		138,646,200	170,930,700
Other ports.....	280,566,200	295,684,600	299,545,500
Total to Bombay.....	280,566,200	434,330,800	470,476,200
Madras.....	51,338,400	38,796,600	72,097,400
Bengal.....	497,627,300	543,569,100	591,112,400
Burma.....	36,866,800	33,153,000	50,896,300
Straits Settlements.....	42,400,200	49,164,600	49,599,900
Ceylon.....	12,221,800	9,256,500	13,776,800
Australia.....	71,882,600	90,552,000	86,739,300
New Zealand.....	17,093,300	19,225,600	21,295,200
Canada.....	34,406,100	53,295,400	41,258,300
British West India Islands (including Bahamas) and			
British Guiana.....	18,822,800	17,495,900	20,271,000
Other countries.....	91,799,700	106,258,800	112,862,600
Total.....	2,662,253,500	2,864,158,400	3,316,094,700
Total value.....	\$153,823,734	\$177,215,211	\$217,181,189

YARN CONTRACTS AND CONDITIONS OF SALES.

The conditions of the sale of cotton yarn in Manchester have been altered considerably during the past 25 or 30 years—in the manner of selling, discounts, time allowed and the mode of payment, the increased fineness of yarn required for the same make of cloth, the exactitude with which the buyer insists on his contract being kept, and in many other respects.

A quarter century ago almost every Lancashire spinner had a yarn agent at Manchester, through whom the whole of his production was sold, the spinner visiting Manchester only once or twice a week. His yarns were consigned to the agent's warehouse and from there sent to the weave-mill purchaser in the required quantities. An account current was kept between agent and spinner and settlements made at intervals, interest charged or allowed, as the balances required.

This was the custom in the days of private firms, but with the inception of the limited liability movement many companies were formed under the new law. As a result competition became greater and efforts were made to reduce selling charges by bringing buyer and seller together.

At present most firms have their own salesman, who will sell to any and all agents or cloth manufacturers. Some spinners keep to the old system of retaining an agent in Manchester through whom all sales are made, but these are diminishing yearly. This system originally applied to the sale of yarn for export, but it is now done direct with the shipper.

In export business a noticeable change has taken place in the method of delivery. Formerly all cop yarn was exported in casks or barrels and fine yarn in cases, supplied or paid for by the shipper. Quantities of yarns are now consigned to the Continent in the spinners' cases and returned when empty, thus saving the expense of cases. Some firms, however, still send yarn abroad in cases paid for by the manufacturer and not returned.

RANGE OF DISCOUNTS—FINER COUNTS.

Discounts previously allowed were different from those now obtained. It was customary for the yarn agent to allow the manufacturer $1\frac{1}{2}$ per cent discount for payment in 30 days. The agent's terms with the spinner were 4 per cent in 14 days, 1 per cent for selling and one-half per cent for guaranteeing payment of accounts. The yarn agent's terms with the spinner for shipping were $2\frac{1}{2}$ per cent in 14 days. When the spinner sold direct to the shipper the terms were $1\frac{1}{2}$ per cent in 14 days.

This system has been completely changed. The manufacturer now pays the spinner or agent in 14 days and is allowed $2\frac{1}{2}$ per cent discount, though some pay on the next market day after delivery and get 3 per cent discount, the extra one-half per cent working out for the 14 days to 13 per cent per annum.

Another change in this market is the increasing demand for finer counts of yarn for standard cloths. Ten years ago an ordinary print cloth was made from 32s filling and 36s warp, while 36s or 38s filling and 42s or 44s warp are now demanded. This procedure has taxed the spinner in compelling him to use better grade cotton, increasing the cost of production, and has necessitated higher skilled labor.

Manufacturers now submit yarn to a severer test than in former years with modern appliances because of the (1) increased fineness of yarn; (2) greater variations in cotton, making irregularity in yarn; (3) increased speed of machinery, necessitating regularity of yarn; (4) importance of obtaining maximum production.

RULES GOVERNING SALES OF YARN.

Practically all Lancashire spinners sell under the rules of the Manchester Yarn Contract Conference, which read as follows:

(1) The actual weight of cop yarn shall be invoiced, including tubes, if the yarn be ordered on tubes.

(2) (a) When warps or back beams are sold on the basis of scale weight and the counts are coarse, the seller may not invoice in excess of 1 per cent over the calculation weight.

(b) When sold by calculation weight, any deficiency exceeding 1 per cent shall be allowed to the buyer.

(3) For bundle yarns, a pressed 10-pound bundle must contain not less than 9 pounds 14 ounces, and a pressed 5-pound bundle not less than 4 pounds 15 ounces of yarn. This rule does not apply to long bundles.

(4) The number of hanks in a bundle, taking 840 yards to the hank, must indicate the counts of the yarns, "sewings" and "fancy yarns" excepted.

(5) In case of dispute as to counts, length, weight, or condition, the yarn shall be tested by and according to the rules of the Manchester Testing House, and its certificates shall be binding on both parties, who, however, shall have the right to be represented when the samples to be tested are drawn.

(6) Either buyer or seller has the right to ask the Manchester Testing House to repeat the test, and in that case the average result of the tests shall be taken as final and binding on both parties.

(7) The seller has the right to replace rejected yarn, if he offers to do so within the original time of delivery, and free of all expenses to the buyer.

(8) If "delivery as required" is specified, or if no time is specified, the contract must be completed within six months, and particulars furnished accordingly.

(9) "Delivery to follow" shall be held to mean at the same rate of delivery as that of the last preceding contract for the same description and quality of yarn.

(10) If a contract is entered for delivery at specified dates, the cancellation of any portion shall not affect the remainder of the contract, each portion being deemed a separate contract.

(11) Payment of an overdue account shall be a condition precedent to further delivery. Delivery may be suspended by the seller whenever any payment is in arrears for accepted delivery, or for any delivery respecting which formal notice of rejection or claim has not been given by the buyer.

(12) In case of a strike, lockout, breakdown, fire, or other unavoidable occurrence, the party affected shall give written notice of his inability to make or accept delivery (as the case may be), and it shall then be at the option of the other side, the aggrieved party, either to agree to the postponement of delivery, or within 10 days to give notice to close the contract, and to pay or receive the difference in price, such difference to be fixed by the Tribunal of Arbitration. Contracts for yarn for shipment to foreign countries are excepted from this rule.

(13) In default of delivery by the seller at the rate or within the time specified in the contract, of any quantity of yarn bought from him, the buyer may purchase such quantity of similar quality in the open market, charging to the seller the excess (if any) over the contract price which he may have had to pay in making such purchase. In default of acceptance of delivery by the buyer at the rate or within the time specified in the contract of any quantity of yarn sold to him, the seller may dispose of such quantity in the open market, charging to the buyer the deficiency, if any, as between the contract price and the price realized by such sale. In either case three days' notice in writing shall be given of the intention either to buy or sell, and the quantity of yarn bought or sold shall be deducted from the contract.

(14) In case of dispute the decision whether a delivery may or may not be rejected, and what damages shall be paid for breach of contract, shall be left to the Tribunal of Arbitration.

Where yarn is sold under the above rules, the following remark is made at the foot of the contract: "Except as may be specified herein, this contract is made under the rules of the Manchester Yarn Contract Conference. All cases of dispute arising under this contract are to be finally decided by the Tribunal of Arbitration recognized by that conference."

SALES OF YARN ABROAD.

British exports of cotton yarn made large increases during the first half of 1911 over the preceding two half years. The following statistics cover the quantities sold abroad during this period compared with the first six months of the two preceding years, the total values also being shown:

Country or port.	1909	1910	1911
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Russia.....	832,300	775,300	1,534,400
Sweden.....	695,300	651,300	683,900
Norway.....	792,100	986,900	978,100
Denmark.....	853,400	621,000	606,000
Germany.....	19,820,400	24,012,400	28,672,200
Netherlands.....	22,281,600	20,350,600	22,846,300
Belgium.....	2,788,700	2,188,400	2,018,400
France.....	2,638,400	2,864,500	2,268,900
Austria-Hungary.....	2,788,600	2,604,400	3,026,700
Bulgaria.....	3,943,200	1,408,300	2,123,900
Roumania.....	4,437,800	2,811,500	4,692,800
Turkey.....	7,911,600	4,066,100	4,335,600
Egypt.....	1,482,900	1,044,400	1,060,900
Dutch East Indies.....	434,700	332,800	457,500
China (Including Hongkong).....	3,974,800	527,300	1,013,000
United States.....	3,465,800	3,391,600	3,268,100
Argentina.....	1,044,500	1,052,400	682,500
British India:			
Bombay.....	9,008,600	4,020,400	7,206,000
Madras.....	2,567,500	3,755,200	4,990,700
Bengal (Including Eastern Bengal and Assam).....	2,986,100	2,924,600	4,957,400
Burma.....	478,700	1,369,600	1,272,500
Straits Settlements.....	681,700	685,400	763,800
Canada.....	661,900	1,535,000	1,266,600
Other countries.....	9,895,600	9,435,700	11,901,600
Total.....	106,646,200	93,415,100	112,627,800
Total value.....	\$27,571,473	\$30,628,096	\$39,285,790

FOREIGN TRADE RESUMÉ.

The export trade, of course, is always the prime factor in the British cotton-mill industry, which its centralization so materially aids. Referring again to the statistics of shipments of cloth and yarn shown on preceding pages, the following record is now given to illustrate the substantial and continuous growth of this trade, despite the occasional dull years. The figures are for the first six months of the respective years and cover the past decade:

Half year.	Cotton yarns.		Piece goods.		Total value all cotton goods.
	Pounds.	Value.	Yards.	Value.	
1902.....	83,645,400	\$17,646,459	2,704,335,700	\$134,952,975	\$158,318,433
1903.....	79,504,300	17,943,627	2,621,587,700	133,789,745	177,798,157
1904.....	76,568,500	21,042,945	2,583,484,300	143,702,654	191,246,257
1905.....	97,967,100	23,703,066	3,005,471,300	167,565,318	216,374,060
1906.....	106,146,400	27,958,123	3,116,703,600	178,943,112	236,324,873
1907.....	112,918,000	34,118,783	3,135,841,600	192,588,988	259,135,178
1908.....	115,227,600	34,676,796	2,848,750,800	181,234,285	246,337,495
1909.....	106,646,200	27,571,473	2,662,453,500	153,823,734	211,990,581
1910.....	93,415,100	30,628,096	2,864,158,400	177,215,211	243,643,347
1911.....	112,627,800	39,285,790	3,316,094,700	217,181,189	292,319,404

British exports of all classes of cotton manufactures passed the half-billion-dollar mark last year for the first time, the total reaching \$515,438,394 in value. However, even this volume is being surpassed in 1911, the exports reaching \$292,319,404 during the first half of the year. If the activity of the first six months of 1911 is maintained during the balance of the year the foreign sales of British cotton goods will almost reach \$600,000,000. Two-thirds of these manufactures are produced from cotton grown in the United States, the British imports of American cotton in 1910 having been 3,675,322 bales of 400 pounds each, and only 1,256,530 bales from all other countries, including British colonies.





DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 48

COTTON GOODS IN ITALY

By

RALPH M. ODELL

Commercial Agent of the Department of Commerce and Labor

**TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD**



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1912

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LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE AND LABOR,
OFFICE OF THE SECRETARY,
Washington, March 9, 1912.

SIR: In compliance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1912, approved March 4, 1911, I have the honor to transmit herewith a report by Commercial Agent Ralph M. Odell, of this department, entitled "Cotton Goods in Italy," which contains the results of his investigations in that country.

Respectfully,

BENJ. S. CABLE,
Acting Secretary.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, January 20, 1912.

SIR: I have the honor to submit herewith a report on the cotton industry and trade of Italy by Commercial Agent Ralph M. Odell. The fact that Italy's exports of cotton manufactures have practically doubled within the past seven years is sufficient indication of the importance of this nation in the world's trade. The Italian cotton industry, in spite of seemingly insurmountable obstacles, has had a remarkable growth, and Italian goods are competing with American, English, and German products in many of the important markets of the world. Mr. Odell has traced the growth of the industry and has indicated the factors that have contributed to its success. The methods used by Italy in developing its export trade in cotton goods are given in detail, in the belief that they will be of interest and value to American cotton manufacturers in their efforts to secure a larger share of the world's trade.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

TO HON. CHARLES NAGEL,
Secretary of Commerce and Labor.

COTTON GOODS IN ITALY.

COTTON MANUFACTURING.

CHARACTER AND DEVELOPMENT OF INDUSTRY.

Among the cotton-manufacturing countries of the world Italy ranks seventh in the number of spindles and eighth in the value of exports. Cotton manufacturing is one of the chief industries of the country, and the products of the mills constitute the largest item in Italy's exports of manufactured articles.

Cotton was an article of commerce in Italy long before its introduction into England; and in the thirteenth and fourteenth centuries Milan, Florence, Venice, and Genoa were important markets from which raw cotton was distributed to the workers in the Netherlands, who later introduced the industry into Lancashire. However, there was practically no machine spinning in those days, and weaving was carried on mainly as a cottage industry.

It was not until the latter part of the nineteenth century that great development took place, and the progress of the industry in the past 25 years has been little short of marvelous. Without the advantage of a supply of cotton, coal, or iron for machinery, and with a class of cheap but untrained labor, the manufacturers set boldly to the task, and in a comparatively short time have built up an industry that occupies a position next in importance to that of the United States in the world's cotton-goods trade.

CAUSE OF RAPID EXPANSION.

Two factors at home have stimulated the growth of the industry. The tariffs of 1878 and 1887, the latter highly protective, practically shut out foreign goods and enabled the native mills to occupy the domestic market. In more recent years a factor leading to the building of many mills was the law of 1902, which went into effect in 1907 and which prohibited night work by women and children in cotton mills. Formerly nearly all the mills operated at night, but as women and children constitute a large majority of the operatives the law made it impossible to continue the system. As the mills, working in the day only, could not supply the demands of the trade, there was a rapid increase in the number of factories to offset the effect of the law.

Some idea of the growth of the industry may be gathered from the following statistics for selected years:

Years.	Imports of raw cotton.	Spindles.	Looms.	Opera- tives.
	<i>Bales.</i>			
1877.....	112,252	764,862	27,817	53,484
1900.....	539,633	2,300,000	78,306	135,198
1907.....	961,050	3,700,000	122,150	160,220
1910.....	709,429	4,576,000	134,385	207,312

The foregoing shows that the number of spindles has increased nearly sevenfold in a little more than a quarter of a century, while in the same period the number of looms has increased from 27,817 to 134,385. It is rather difficult to ascertain the exact number, as taxes are levied on the number of spindles or looms, and this system makes manufacturers reticent in the matter of furnishing statistics. The figures in the table were furnished by the Associazione Cotoniera Italiana, the best authority on the industry in Italy, and though possibly slightly less than the actual number, are practically correct.

The decrease in the imports of raw cotton in 1910, as compared with 1907, was due in part to the world-wide crisis in the industry and to the curtailment of production, but it is also accounted for by the fact that the mills are gradually engaging in the spinning of finer numbers of yarn than formerly. Although Italian mills can not yet compete with England and Switzerland¹ in the finer counts of yarn, they are no longer confined to low numbers, 80s, 100s, and even 120s being spun in some of the establishments.

PROGRESS AS REVEALED BY STATISTICS.

The following table shows, in round figures, the progress of the industry during the past 10 years:

Years.	Imports of raw cotton.	Active spindles.	Production.	Exports.
	<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>
1900.....	271,000,000	2,300,000	242,000,000	44,000,000
1901.....	288,000,000	2,500,000	264,000,000	53,468,000
1902.....	311,444,000	2,700,000	284,396,000	60,676,000
1903.....	324,573,000	2,700,000	284,396,000	58,391,000
1904.....	324,931,000	2,700,000	286,600,000	74,996,000
1905.....	345,223,000	3,000,000	317,465,000	77,419,000
1906.....	403,484,000	3,300,000	348,330,000	84,588,000
1907.....	480,525,000	3,700,000	392,422,000	74,042,000
1908.....	455,786,000	3,800,000	401,241,000	66,644,000
1909.....	420,729,000	4,100,000	423,287,000	89,984,000
1910.....	384,940,000	4,576,000	338,941,000	107,070,000

The decreased production in 1910 was due to short-time running. At a later point in this report the growth of the export trade will be treated at length, but it is interesting to note here that while the exports amounted to less than 20 per cent of the total production of cotton manufactures in 1900, they formed about 30 per cent of the total in 1910.

¹ In Italy the number of bales of cotton used per year to the 1,000 spindles is 254.98. In England the corresponding figure is 80.24 and in Switzerland 62.58.

CHARACTER OF THE INDUSTRY—SWISS INTERESTS.

The industry in Italy is modeled somewhat after that of England, spinning and weaving being carried on in separate mills; the American system of having spinning and weaving in one building is unknown. It is not uncommon, however, for one firm to own both spinning and weaving factories, and some of the larger concerns also operate bleacheries, dye works, and printing establishments. Differentiation of functions is not carried so far as in England or Switzerland, where the operations of spinning and weaving are entirely distinct and separate.

The customary size of the spinning mills is 30,000 to 50,000 spindles. Some firms operate less than this number, while others have more than 100,000, although in the latter case the spindles are usually distributed in two or more mills located in different towns. Weaving mills range from 500 to 2,000 looms, but there are many smaller concerns.

An important part in the development of the Italian cotton industry has been played by the Swiss. In former years Italy was one of Switzerland's best customers for cotton goods, but after Italy's high tariff went into effect in 1887 Switzerland lost a large part of its trade in the country. As a result many of the Swiss manufacturers built mills in Italy, where they found a plentiful supply of cheap labor and an abundance of water power. To-day these factories are among the most successful in Italy, and even in mills owned by Italians it is not unusual to find a Swiss manager or superintendent; undoubtedly the skill of these men has contributed largely to the success of the Italian industry.

PRINCIPAL MANUFACTURING DISTRICTS.

The heart of the cotton industry in Italy lies in the northern part of the country, in Lombardy, Piedmont, and Venetia, where cotton manufacturing had its beginning. Natural advantages, good climate, an abundance of waterfalls for the development of power, and a supply of labor that is more efficient than the labor of southern Italy have tended to confine the industry to the region named.

The total capital invested in the cotton industry in Italy is estimated at 600,000,000 lire (\$115,800,000), and the value of the products is 500,000,000 to 600,000,000 lire (\$96,500,000 to \$115,800,000).

According to the textile directory of one of the cotton-trade journals in Milan, there are 1,661 establishments engaged in the industry, divided as follows: Spinning mills 171, twisting mills 159, weaving mills (power) 428, weaving mills (hand) 120, dyeing establishments 219, printing establishments 34, bleaching establishments 162, mercerizing establishments 56, knit-goods mills 39, sewing-thread mills 14, waste-spinning mills 66, waddings and absorbent cotton 14, miscellaneous 179. Of these 978 are located in Lombardy, 249 in Piedmont, 131 in Tuscany, 86 in Liguria, 76 in Venetia, and 70 in Campania.

CENSUS OF SPINDLES AND LOOMS BY DISTRICTS.

The Cotton Manufacturers' Association of Italy has recently completed a census of the spindles and the power looms in Italy, by districts. These statistics are doubtless the most accurate obtain-

able, and through the courtesy of the association I was given the figures in advance of their publication. In the table following the spindles are classified as to whether belonging to firms operating spinning mills only or to firms operating both spinning and weaving mills.

Districts.	Spindles.			Power looms.
	Owned by spinning-mill firms.	Owned by spinning and weaving mill firms.	Total.	
Lombardy.....	741,068	1,419,158	2,160,216	75,912
Piedmont.....	453,328	543,896	1,027,224	29,896
Venetia.....	241,373	494,578	735,951	14,538
Liguria.....	206,746	162,492	368,238	6,121
Central Italy.....	112,876	101,504	214,380	4,581
Southern Italy and Sicily.....	45,520	24,396	69,916	4,122
Total.....	1,829,901	2,746,024	4,575,925	134,385

The foregoing table shows that nearly 50 per cent of the spindles are located in Lombardy and that over 80 per cent are confined to Lombardy, Piedmont, and Venetia.

DEVELOPMENT IN THE SOUTH.

The industry has, in more recent years, developed in the south, particularly in Naples. The Government has endeavored to alleviate the unemployment prevalent in southern Italy by granting concessions for the encouragement of industries. To this end a special zone was marked out in the neighborhood of Naples in 1904 and firms that establish factories within its limits enjoy the following privileges: Free sites for mills, exemption from taxes for 10 years, free use of the water of the rivers (all of which are owned by the Government) for power for the same period, and permission to import machinery free of duty.

This policy has not, however, been attended with the degree of success that was anticipated, owing to the fact that the Neapolitan labor while cheap is not efficient. The general conclusion of the mill owners of the north has been that the superior labor of Lombardy and Piedmont is worth more than the financial saving in the South.

LOMBARDY REGION.

In Lombardy the Province of Milan ranks first in importance, followed by Como, Bergamo, and Brescia. The valley of Seriana north-west of Milan, in the Provinces of Bergamo and Como, is an important manufacturing district on account of the advantage of cheap power furnished by the rivers there. The important cotton-mill towns of Busto Arsizio, with more than 40 factories, mainly spinning; Monza, with nearly 30; and Gallarate and Legnano are all located in the Province of Milan.

The city of Milan itself is the industrial capital of Italy. Here many of the firms operating mills in various parts of Lombardy

maintain offices. The cotton-mill machinery and supply dealers, the raw-cotton agents, and the exporting houses are all centered in Milan, and practically all the various transactions connected with the industry are carried on there.

Milan is also the headquarters of the *Associazione Cotoniera Italiana*, or Italian Cotton Manufacturers' Association, of which practically all the leading cotton manufacturers are members, and which is one of the strongest organizations of its kind in the world. Its services to the industry are many and varied. It furnishes daily information in regard to the raw cotton market and weekly confidential reports on the transactions in yarns. It takes an active part in tariff discussions and in other legislative matters affecting the industry. It collects statistics and data and is an authority on cotton manufacturing in Italy. Moreover, through its many correspondents abroad it gathers valuable information in regard to the cotton industry and trade in all parts of the world and furnishes its members with confidential information about foreign markets and trade opportunities. Its monthly bulletin is an exceedingly creditable trade journal, and in addition to trade information it prints technical articles dealing with every phase of the industry.

PIEDMONT AND VENETIA.

In the Piedmont region the cotton industry is practically confined to the Provinces of Turin and Novara, which are about equal in importance as regards the number of spindles and looms. In general, the yarns spun in the Province of Turin are of a finer number and the cloth woven is of a higher quality than those produced in Novara and in Lombardy. In the cities of Busto Arsizio, Monza, Gallarate, and Novara the manufacture of colored goods is carried on extensively, while the mills in the Province of Bergamo spin coarse to medium yarns and weave heavy gray cloths. The coarsest spinning, however, is done in Venetia, where Indian cotton is used extensively, and the principal classes of goods manufactured are colored fabrics for the Levant trade and coarse sheetings and drills.

While certain classes of work preponderate in certain districts there is no such complete specialization as obtains in the English cotton industry, and reference to any locality as the seat of any particular branch of the industry should be taken in a broad and general sense.

HAND-LOOM WEAVING.

Italy is a country in which hand-loom weaving still flourishes. Ten years ago it was estimated that there were 60,000 hand looms in Italy, and although it is difficult to ascertain the exact number now in use, as many are owned by the peasants in obscure places, it is estimated at about 25,000.

The number in actual operation necessarily varies from year to year and from season to season. Hand-loom weaving is primarily a home industry and the people engage in it when they have nothing else to do. In the spring and fall, when the peasants are busy in the fields, the number in operation decreases and the maximum number is operated in the winter months. The decline in hand-loom weaving has been caused not only by the direct competition of mechanical looms but by the resultant fact that cotton goods have

become so cheap that the peasants, who are in better financial condition than formerly, prefer to buy rather than to weave for their own consumption.

In addition to the hand looms owned and operated by individuals, there are many under the supervision of firms that also operate mechanical looms. The weaver obtains the yarn from the mill after it is carefully weighed. When the cloth is finished and brought to the factory the weight is again taken, and the weaver is paid by the piece, as in mechanical weaving. The looms are usually rented by the year or purchased outright, by the weavers themselves. Sometimes, however, both hand and power looms are to be found in a weave shed. For example, one mill I visited had nearly 100 hand looms and 200 power looms working, and the manager stated that in addition to these the firm had nearly 700 hand looms under its supervision in the village and its environs. This system under which a company has looms working for it outside of its own plant is not confined to hand looms, and a number of small weaving plants or sheds may be under the control of a larger firm although not owned by it.

CENTERS OF HAND INDUSTRY—WAGES.

While hand-loom weaving is carried on in various parts of Italy, Monza in Lombardy and Chieri in Piedmont are generally regarded as the centers of the industry. At Monza the chief product consists of woven tapestries and upholstery cloths, and the annual output of these goods is valued at about \$1,000,000. More than half of this amount is exported and a market for the tapestries has been found in the United States. They are usually woven about 18 or 20 by 60 inches and are sold by the manufacturer at prices ranging from \$2.50 to \$7 per dozen. They are woven on a Jacquard hand loom and are usually ornamented with Italian scenes.

In Chieri there are 20 hand-loom weaving firms, of which several own or operate from 500 to 600 looms each. The staple articles of manufacture are fancy dress goods, fancy colored quilts (*gros de Tours*), and fancy waistcoat fabrics. In all of these lines there is a considerable export trade, particularly with South America.

The price paid for hand-loom weaving is higher than that for weaving similar material on a mechanical loom, yet the hand looms continue to compete with the latter. I made many inquiries as to the cause of this, and it seemed to be the opinion that they are able to compete successfully only in the lines already mentioned, where the speed of the loom is necessarily slow and where the skill of the operative is an important factor in the weaving of the cloth. In weaving by hand looms there is also a saving not only in power but in the cost of machinery. A Jacquard hand loom can be purchased for about \$20, and they can often be rented for a much lower figure.

Another reason for the continuance of hand-loom weaving in Italy is the fact that it has been carried on for generations. In a center like Chieri the people are averse to entering a cotton factory, with its regular hours, and they chafe under the strict discipline and close supervision which obtain there. They prefer to weave in their own homes, to work when they choose and as their fancy dictates. The manager of one of the Chieri mills informed me that he had experienced great difficulty in obtaining labor for his mill owing to this

feeling on the part of the people, and it was his opinion that hand-loom weaving in certain lines would continue to hold a place in the Italian cotton industry.

MILL CONSTRUCTION AND EQUIPMENT.

Most of the Italian mills are modern and fairly large buildings. Some are of brick, but the majority are of reenforced concrete construction, and they are built in the style of the most up-to-date American or English mills. Many of them have been planned by Lancashire engineering firms, which furnish most of the machinery. A striking feature of those built in recent years is the entire absence of wood, making them practically fireproof.

Spinning mills were formerly of one story, but the tendency in the past few years has been toward two and three story structures, in order to obtain a more complete separation of the several departments of opening, carding, and spinning. Weaving mills are almost all one story, with the familiar saw-tooth roof, affording ample light.

Italian mills usually present a more attractive and pleasing exterior than American mills because the owners take more pride in appearance and are willing to spend a little more for ornamentation. In the interior they are very roomy and spacious, alleys being wider and the distance between machines greater than in American factories.

FIRE PROTECTION—HUMIDIFICATION—LIGHTING.

The mills, as a rule, are well protected against fire, and the fact that they are of concrete construction throughout and that all window frames and doors are of metal reduce the fire risk. Fire insurance rates on cotton mills necessarily vary according to the type of construction, height of buildings—whether one, two, or three stories—and the amount of protection provided. The average, however, is 10 lire per thousand on a one-story spinning mill and 3 lire per thousand on a weaving mill of ordinary construction. These rates are reduced 45 per cent in the case of spinning mills and 35 per cent in the case of weaving mills if automatic sprinklers are installed. Although the cotton manufacturers have endeavored to form a mutual insurance association, their efforts have not been very successful, owing to the fact that many of the mills are insured in the regular companies under contract for a number of years.

The Italian manufacturers, realizing the importance of securing good spinning and weaving conditions through artificial means of humidification, have given much attention to this subject, and humidifiers have been installed in practically all of the important mills. The system most generally in use is that of sending damp air into the rooms from air canals below, through grids in the floor, or through hollow buttresses in the case of two and three story mills. This method has the advantage that it can be used in winter for heating purposes, the air being heated in the storage chamber before it is emitted into the room; in summer good ventilation is secured by changing the air quite frequently. Another means of humidification and one much in use in weaving mills is the injection of fine sprays of water into the rooms. In this system two lines of pipe are used, one for water and another and larger one for compressed air. At

the "heads," placed at intervals of about 15 feet, the air forces the water out in a spray through small apertures.

The mills are all lighted by electricity, arc lights being the rule in both spinning and weaving mills, although in the latter incandescent lamps may sometimes be found.

COST OF CONSTRUCTION.

Land in Italy for building sites costs about 2 lire per square meter (3.58 cents per square foot) in the country districts, and from 5 to 6 lire per square meter (8.96 to 10.76 cents per square foot) in the environs of manufacturing towns. The cost of building a mill varies, of course, with the locality, type of building, and class of yarn or cloth manufactured. There is also a difference from year to year because of the fluctuating prices of machinery, which are low at present on account of the unsatisfactory condition of the cotton industry. In general, it may be stated that a spinning mill complete, with all modern machinery, improvements, fire protection, and humidifiers, costs 60 lire (\$11.58) per spindle; but this price includes, in addition to the mill building, tenements for the operatives. In this case a mill to spin numbers 20 to 30 single yarn is assumed; if a lower number is spun and mules are required, the cost will be slightly more, or if twistors are added there will be an additional expense.

The cost of erecting weaving sheds presents an even wider range, depending not only on the class of goods to be manufactured, whether white or colored, plain or fancy, but also upon the amount of preparatory machinery, dyeing, winding, slashing, etc., and the amount of finishing machinery, starchers, shearers, tenters, or nappers. Assuming a loom to weave plain white cloth 1 meter wide, the cost is from 1,000 lire (\$193) to 1,100 lire (\$212) per loom. The expense of building a mill of 150 looms for fancy colored goods is about 450,000 lire (\$86,850), including a dyehouse for dyeing the yarn and a department for finishing the cloth.

PRICES OF MILL MACHINERY.

The present (September, 1911) prices of cotton-mill machinery of English manufacture f. o. b. Milan are as follows:

Machines.	Cost.
Opener with automatic feeder.....	\$1,010
Intermediate or finisher lapper 40 inches wide.....	710
Revolving flat-top cards 40 inches wide.....	536
Drawing frame, 6 deliveries, 18-inch gauge.....	744
Slubber frame, 90 spindles, size 10 by 4½ inches.....	750
Intermediate frame, 140 spindles, size 10 by 4½ inches.....	873
Fine frame, 160 spindles, size 7 by 2½ inches.....	760
Warp spinning frame, 400 spindles, 5 by 2½ inches.....	870
Filling spinning frame, 400 spindles, 5 by 2½ inches.....	860
Self-acting (mule) spinning frame, 1,000 spindles.....	1,680
Twister, 340 spindles, 5 by 2½ inches.....	720
Winder, 300 spindles.....	510
Beam warper.....	215
Slasher.....	1,290
Silver lap machine.....	380
Ribbon lap machine.....	718
Comber (Nasmith).....	1,220
Plain 2-harness loom 44 inches wide (English).....	78
Plain 3 or 4 harness loom 40 inches wide.....	90
Plain Northrop loom, single box, 44 inches wide.....	240
Jacquard loom, without pattern cards, 44 inches wide.....	175
100-horsepower electric motor, complete.....	940

TARIFF ON MACHINERY—SOURCE OF IMPORTS.

The tariff on spinning and weaving machinery is 6 lire per quintal (\$0.525 per 100 pounds) and 10 lire per quintal (\$0.875 per 100 pounds) on bleaching and dyeing machinery. Practically all the machinery is purchased from abroad, and although the imports have declined considerably in recent years (from \$3,618,421 in 1908 to \$1,228,244 in 1910) this has not been caused by home competition, but by a cessation in the building of new mills during the past two years. There is one firm in Italy engaged in the manufacture of looms, winders, reels, and cloth-room and other machinery of a more or less plain character, but no carding or spinning machinery is manufactured in the country, and it is estimated that more than 90 per cent of all the machinery in the mills is imported.

England ranks first in the imports, of course, and its machinery predominates in both spinning and weaving mills. Switzerland, however, supplies some of the ring spinning frames, many of the spinners preferring them, especially for weft spinning. A number of looms come from Switzerland also, particularly box looms for weaving fancy goods and Northrop looms. Switzerland has the advantage of being close to the market, and the Swiss influence, already mentioned, has undoubtedly been a factor in the sale and use of that country's machinery. However, the English makers devote much attention to the Italian market and are well represented there, and as Switzerland's industry is small and can supply only a limited quantity of the total the bulk of the machinery comes from England.

German competitors have recently made an effort to secure a part of the trade, and they have been fairly successful, owing to their methods of sale and their willingness to build machinery to suit all the requirements of the purchaser, however exacting they may be. As a rule, the Italian mill owners buy the best machinery obtainable, even if more expensive, and they are inclined to discard obsolete or worn-out machinery and install new and more up-to-date kinds. The extent to which gray goods is made in Italy has created a good demand for the Northrop loom, and one of the mills visited had 300 of them in operation. It is estimated that there are 5,000 in use in Italy at present. Jacquards are also widely used in the manufacture of fancy goods. Another popular loom is the Honeger, of Swiss make. It is a dobby loom, the dobby being operated by a pattern card, and it is particularly adapted to the manufacture of fancy colored goods. As a rule, the mills do not confine themselves to one type of loom; plain, dobby, and Jacquard looms are often found in the same establishment, and this makes possible the weaving of many varieties of cloth, which is characteristic of Italian mills.

ESTIMATED COST OF BUILDING AND OPERATING MILLS.

In the *Bolletino Della Cotoniera*, the organ of the Cotton Manufacturers' Association of Italy, an article was recently published showing not only the cost of building a spinning mill in Italy but the cost of operating it and the actual cost of the yarn manufactured. So clearly does it reflect conditions in the Italian cotton industry that the figures are here given.

A spinning mill of 28,000 spindles is assumed, 10,800 being mule spindles and 17,200 ring spindles. The production is 34s warp and 44s filling.

Items.	Amount.
LAND AND BUILDINGS.	
Site for mill (12,000 square meters, at 2 lire)	24,632.00
Buildings, including warehouse, waste house, and home for the director	74,306.00
Equipment of building:	
Heating and humidifying system	4,632.00
Electric lighting system	3,474.00
Belts and ropes for driving	1,920.00
Bobbins, tubes, and spools	3,476.00
Drinking-water supply, including pump	2,122.00
Boxes for bobbins and spools	676.00
Office furniture, closets or lockers for operatives	772.00
Machine-shop equipment	2,800.00
Fire extinguishers and pails	570.00
Total	101,006.00
MACHINERY.	
Steam power plant to generate 500 electric horsepower	24,704.00
Shafting and pulleys	5,790.00
Upper-room machinery	6,851.00
50 cards	20,108.00
36 drawing frames of three deliveries each	6,948.00
Roving machinery:	
340 spindles of slubbing	35,512.00
1,260 spindles of intermediates	
3,800 spindles of fine frames	
10,800 mule spindles	18,336.00
17,200 ring spindles (12,000 warp and 5,200 filling)	28,021.00
Machine for making baling twine	126.10
Total	108,404.00
Total cost of mill	207,440.10
OPERATION.	
Fixed charges:	
5 per cent on above investment	13,372.00
5 per cent on a minimum capital of \$77,200	3,890.00
Depreciation of 7 per cent on machinery, etc., and 3 per cent on buildings	15,421.64
Total	32,683.64
Wages of operatives (205 hands at an average wage of 2.15 lire (41.406 cents) per day, 304 days per year	26,802.00
General expenses and supplies:	
Taxes	2,380.00
Insurance, fire, and liability	2,509.00
Salaries of director and clerks	4,246.00
Fuel (\$7.33 per ton), 11 hours per day, 304 days per year	11,880.00
Paper tubes and spools	2,570.00
Packing and cases	676.50
Belting and rope	772.00
Oil	676.50
Repairs	772.00
Electric lights	251.00
Miscellaneous	301.20
Office expenses	212.20
Commissions and travelling expenses	482.50
Freights	1,158.00
Discounts and interest	1,980.00
Total	30,615.20
Total fixed charges and operating expenses	63,298.84
PRODUCTION.	
12,000 ring spindles on No. 34 warp, at 110 grams (0.2425 pounds) per spindle per day	1,894.632
5,200 ring spindles on No. 44 filling, at 76 grams	1,264.363
10,800 mule spindles on No. 44 filling, at 63 grams	1,485.004
Total	1,006.839

¹ Pounds.

The average number of the yarn produced is 38. The cost of production per pound (728,263 kilos or 1,605,529 pounds, costing \$89,130.85) is 5.5514 cents. If the mill develops its power from water near the mill, the cost of production is about 0.48 cent per pound less than the figure quoted.

TAXES ON MILLS.

The taxes on cotton mills are rather high in Italy, being on an average 0.30 lira (\$0.0579) per spindle for spinning mills and 9 lire (\$1.787) per loom in the case of weaving mills. In addition, 5 lire (\$0.965) per horsepower is levied on the power used and for electric lights 0.6 lira (11.58 cents) per kilowatt hour. Moreover, when a mill uses the water of a river for the development of its power there is an additional tax of 3 lire (\$0.579) per horsepower. Efforts are being made to have the taxes reduced. Owing to the crisis in the industry and the losses that many of them have suffered, the mill owners are inclined to believe that their efforts will be successful and that a substantial reduction will be granted.

KINDS AND COST OF POWER.

Accurate statistics of the power used in the Italian cotton industry are not obtainable, but a prominent manufacturer stated that the spinning, weaving, and finishing (including printing) mills use approximately 225,000 horsepower, of which the largest proportion is electric. Italy is rich in rivers for the development of power, it having been estimated that 5,000,000 horsepower can be developed from the streams.

One of the striking features of the Italian cotton industry is the extensive use of electric power for driving, due partly to the fact that all coal must be imported and partly to the existence of good waterfalls. Many factories are built convenient to the streams from which electric power can be generated, though in some cases the machinery is driven directly by water turbines. Owing to the growing magnitude of the industry, however, it is no longer possible to find suitable sites along the banks of rivers, and the abundant water power in the Alpine valleys is generally used to generate electric power, which is transmitted to the mills.

In some cases the owners generate their own power, but many of them obtain it from a central distributing plant, separately owned. In the important cotton-mill town of Busto Arsizio several of the largest mills secure power from a plant in Switzerland, nearly 200 miles away. These central power plants as well as the firms which generate their own power usually have an auxiliary steam plant in reserve against a shortage of water. The mills using steam power exclusively are generally those situated at great distances from water power.

Many of the steam engines as well as hydraulic turbines and electric generators in use are manufactured in Italy, where rapid strides in the engineering industry have been made in recent years. Steam engines to the value of \$1,270,000 and electric machinery to the value of \$2,920,000 were imported in 1910, the former coming chiefly from

England and Germany and the latter from Germany and Switzerland.

IMPORTS OF COAL.

Coal imports in 1910 amounted to 9,314,000 tons, which is almost double the imports in 1902, which were 5,206,000 tons. The increasing consumption of coal is due not only to the more extensive use of steam engines for power, but to the fact, already mentioned, that electric-power plants usually maintain steam plants as well because the flow of the streams is susceptible to wide variation and sometimes dwindles to almost nothing in winter months.

Coal comes mostly from England, that country supplying about 85 per cent of the total amount used in Italy. American coal is being used more and more, and the imports from the United States, which amounted to only 19,182 tons in 1908, increased to 154,629 tons in 1910. Two or three American companies are now represented in Milan and they report an increasing demand for their coal.

There is every reason to believe that American coal can find a good market in Italy, particularly if it is offered at a price as low as that from England. The coal most largely used is a good quality of steam coal of the variety obtained in the Pocahontas fields in West Virginia. The present price of English Cardiff coal is about 40 lire (\$7.72) per ton, landed at the mill. It costs from 120 to 180 lire (\$23.15 to \$34.75) per horsepower per year to develop steam power in Italy. The variation in the cost is due to the different types of engines in use. The lowest cost is for a modern compound condensing engine.

HYDROELECTRIC POWER—USE OF GAS ENGINES.

The cost of installing a hydroelectric plant in Italy ranges from 500 to 700 lire (\$96.50 to \$135) per horsepower, according to the proximity of water, size of plant, etc. Where a mill develops its own power, the cost per horsepower per year is 70 to 100 lire (\$13.50 to \$19.30), while the central power plants charge 120 to 150 lire (\$23.15 to \$28.95) per horsepower, which is practically the same as the cost in the United States. Where water power is utilized for driving direct, the cost per horsepower per year is from 50 to 80 lire (\$9.65 to \$15.45).

The use of gas engines is not very extensive, and they are confined to small plants where not much power is required. The cost is 80 to 100 lire (\$15.45 to \$19.30) per horsepower per year.

METHODS OF DRIVING.

Rope driving is usually employed in steam-power mills. In those with electric power there is a growing tendency to use individual motors and a number of the largest and latest improved mills have adopted this method. In several mills visited practically every machine is driven by a separate motor. In the spinning rooms an 8-horsepower motor is used for each frame of 440 spindles and speed

changes are effected by means of interchangeable pulleys. Another method of driving in common use is to have each line of shafting driven by two motors, one at each end. Still other mills visited are driven by a large motor on each floor of the building. Some water-driven mills have adopted the individual drive, and in one of them I visited every machine is driven by a small turbine about 1-foot in diameter, the flow of water being regulated by a valve.

MILL SUPPLIES.

As Italy imports all spinning and practically all weaving machinery, it is necessary for each mill to have its own foundry and machine shop where, in case of breakage, repairs can be made and minor parts cast. These shops are usually well equipped with tools such as lathes, planers, drills, gear-cutting machines, key-seating machines, and brazing outfits.

The narrow and light weights of leather belting are furnished largely by Italian manufacturers, because they are cheaper than the imported article and seem to give general satisfaction. In the wide, heavy grades imported belting is usually preferred to the home product, and the demand is supplied by England, France, and Germany, in the order named. A leading American manufacturer of belting has recently established an agency in Milan, and the representative of the firm states that business has been very satisfactory. American manufacturers of transmission belts who desire to enter the export field will undoubtedly find opportunities in the Italian market if they are willing to offer the same terms of credit as those granted by competing nations and if they give strict attention to quality. The climate in Italy is somewhat damper than in America, and belts for this market should be so made as to resist dampness. The tariff on belting is 85 lire per 100 kilos (\$7.44 per 100 pounds), and the prices of imported belting are as follows:

Width.	Single.		Double.	
	Per meter.	Per yard.	Per meter.	Per yard.
	<i>Lire.</i>		<i>Lire.</i>	
2 inches	2.40	\$0.423	4.20	\$0.740
3 inches	4.10	.727	6.30	1.111
4 inches	5.10	.899	8.30	1.464

ROVING CANS AND BOXES—BOBBINS.

Fiber roving cans and boxes are all made in Italy as well as fiber bobbins and spools. Most of the wooden bobbins and shuttles are imported, the foreign article being preferred. However, wooden bobbins are not so extensively used in the spinning mills as in the United States, and fiber bobbins are used almost universally except on roving machines. The reason for this is that, aside from being cheaper, they are much lighter and more easily handled. Spinning and weaving mills, as already pointed out, are seldom

located together, and the yarn is often shipped 15, 25, or even 100 miles. As the yarn is frequently sold to the weaving mill on bobbins, there is a considerable saving in freight. Also it is possible to get more yarn on a fiber than on a wooden bobbin, which means less stoppage of spinning frames for doffing.

To such an extent has this preference been carried that fiber bobbins are also used on Northrop looms, a wooden skewer with the necessary rings on the butt having been especially invented for this purpose. The fiber bobbins of yarn as they come from the spinning frame are fitted over the skewer which, in turn, fits in the battery of the loom.

There are several large manufactories of paper tubes and bobbins in Italy, and one firm not only supplies more than 50 per cent of the home demand, but ships its product to South American mills.

There is a market for wooden roving bobbins in Italy and American manufacturers would do well to investigate the field. At present most of these bobbins are supplied by England, but the prices are higher than those prevailing in the United States. For example, an 11-inch slubber bobbin (10-inch traverse) with metal shield is quoted at 23.50 lire (\$4.53) per hundred, and an 8-inch speeder bobbin (7-inch traverse) at 14.50 lire (\$2.80) per hundred, these prices being f. o. b. factory. Freight amounts to 11 lire per 100 kilograms (\$0.966 per 100 pounds) from England, and the customs duty is 7 lire per 100 kilos (\$0.613 per 100 pounds).

The slubber bobbin mentioned weighs 17 kilos (37.4 pounds) to the hundred bobbins, and the speeder bobbin 9 kilos (19.8 pounds) to the hundred. Black enameled warp bobbins of wood with a metal shield are quoted at 13.40 lire (\$2.58) per hundred f. o. b. Milan, for the 7-inch size (6-inch traverse).

SHUTTLES, LUBRICATING OIL, ETC.

Practically all the shuttles come from England. There are two or three small concerns in Italy making shuttles but the foreign manufacturers are able to compete not only in quality but also in price, even after paying freight and duties. The shuttle makers in Italy secure most of their wood from Austria, but it seems to be inferior to the material used in England and the United States, and the managers of the mills stated that they much preferred the imported article. Prices of shuttles in Italy are considerably lower than those obtaining in the United States. For instance, an ordinary English shuttle for a 6-inch bobbin sells at 0.90 lira to 1 lira each (\$2.08 to \$2.31) per dozen. Patent hand-threading shuttles are not used very extensively in Italy.

Most of the lubricating oil used by the cotton mills is American. The customs duty is 5 lire per quintal (\$0.438 per 100 pounds) on heavy oil, 24 lire per quintal (\$2.10 per 100 pounds) on light oil, and 8 lire per quintal (\$0.70 per 100 pounds) on grease; but grease is not used so extensively as in the United States.

Large quantities of dyestuffs and bleaching materials are used in the cotton industry. The former are furnished almost wholly by Germany, while bleaching materials are partly produced in Italy and partly imported.

METHOD OF ENTERING MARKET.

American manufacturers of cotton-mill supplies who contemplate entering this market should be reminded of the fact that Italy is a country of long credits and it is well-nigh useless to attempt to do business on a cash basis. The German and English firms here give three and four months' time and competitors must enter the market on the same basis if an appreciable amount of business is to result. It is also advisable to quote prices in pounds sterling or in francs c. i. f. Genoa.

A Japanese manufacturer of mill supplies recently wrote to one of the largest dealers in cotton-mill machinery and supplies in Milan with a view to securing trade. The letter was a model one in every respect and was written in perfect English, which language is generally understood by the men in the cotton trade here. A complete line of samples of bobbins, spools, shuttles, and travelers was forwarded, with a detailed price list in pounds sterling. The sizes were all given in English terms, and liberal credit was offered. This instance is cited in order to show what efforts are being made to secure trade in mill supplies by a firm in a country much farther away from Italy than the United States.

The disinclination of Italians to pay cash is not due to inability to pay, but to the prevailing credit system. The importer may be able and willing to pay cash, but the customer to whom he sells demands credit, and gets it; and there are many importers whose financial rating may be of the highest but who do not always find it convenient or possible to pay cash for shipments. In such cases they naturally turn to the firms who offer longer terms.

One importer of American goods stated that he was willing and able to pay cash and had always done so, but he had found that when the quality of goods shipped to him was below standard he had no recourse and usually had to stand the loss, finding it difficult to adjust a claim after the bill had been paid. This may be an exceptional case, but it is worthy of consideration.

American firms doing the largest business in Italy are those that have a main European branch in Berlin, Hamburg, Paris, or London. By this method it is easier to keep in touch with the trade, which is of supreme importance in securing export business. In Italy, as in all other countries, the man on the spot, with samples and prices, and with a branch house not too far away, from which shipments can be made promptly, is the man who gets the order; he is in a much better position than the man who depends on long-distance correspondence and catalogues printed in English.

There are many Italians willing and anxious to represent American products, but before placing an agency the manufacturer should be sure that he is securing the services of a competent man. While an agent may take up an article and work hard for a time to secure orders, he often becomes discouraged if the orders do not come, and loses the enthusiasm with which he started.

[Samples and prices of bobbins used in Italy, and names of dealers transmitted with this report are filed in the Bureau of Manufactures.]

SOURCE AND COST OF RAW MATERIAL.

Italy imposes a duty of 3 lire per quintal (\$0.263 per 100 pounds) on raw cotton, but this tax on the manufacturers is partly offset by the drawback allowed on exports of cotton goods, which is 4 lire per quintal (\$0.35 per 100 pounds) on yarn, and 4.50 lire (\$0.394 per 100 pounds) on cloth.

In calculating the amount of the drawback there is an allowance of 8 per cent for sizing; if the sizing is more, the weight of the excess is deducted. To ascertain the net weight of the yarn or cloth on which the drawback is payable the following formula is used:

$$Q = \frac{108 \times P}{100 \times A}$$

Q is the net weight without sizing, P the net weight with sizing, and A the per cent of sizing. As a large quantity of the cotton goods exported by Italy is heavily sized, the requirement regarding excess sizing necessitates numerous calculations and often a chemical analysis. This frequently gives rise to controversies between the manufacturer and the customs officials. The Cotton Manufacturers' Association has recently taken steps to have the restriction as to sizing removed entirely, and the indications are that the Government will grant their request, in which case the drawback will be allowed on the full net weight of the goods, exclusive of cases and wrapping.

ORIGIN OF COTTON SUPPLY.

Of the cotton used in Italy in 1910 approximately 56 per cent came from the United States, 35 per cent from India, 6 per cent from Egypt, and the remainder from Asiatic Turkey and Eritrea. The source of the cotton imports is shown in the following table, the bales being 500 pounds:

Countries.	1907	1908	1909	1910
	<i>Bales.</i>	<i>Bales.</i>	<i>Bales.</i>	<i>Bales.</i>
United States.....	663,599	625,778	606,182	436,130
India.....	235,599	223,495	167,526	268,908
Egypt.....	40,383	50,910	45,424	43,233
Asiatic Turkey.....	7,786	8,708	17,010	16,093
Other countries.....	13,683	3,583	5,316	5,006
Total.....	961,050	911,572	841,458	769,429

Practically all of the cotton under the head "other countries" is American cotton that has been reexported from England, Germany, or Switzerland, and is credited to those countries.

The value of all the cotton imported in 1910 was \$61,248,904, this being based on the customs valuation, as follows: American, 193 lire per quintal (16.9 cents per pound); Indian, 142 lire per quintal (12.43 cents per pound); Egyptian, 321 lire per quintal (28.1 cents per pound); other, 167 lire per quintal (14.62 cents per pound).

USE OF INDIAN AND TURKISH COTTON.

Italy is one of the largest users of Indian cotton, its mills having consumed about 20 per cent of the total cotton exports from British India in 1910. This is a factor of considerable importance, because it is chiefly through the extensive use of Indian cotton and other cheaper grades that Italy has been able to produce low-priced goods and sell them in competition with other countries in many of the world's markets. It is usual to run the American and Indian cottons separately, the latter being used mainly for filling yarns and for warp yarns up to No. 20. The advantage in using Indian cotton, however, is now (October 1, 1911) practically lost, owing to the fact that the cost is no lower than for American cotton.

The manufacturers also use cotton from Asiatic Turkey, which is of a better grade than Indian, and slightly cheaper than American. While there is a marked tendency to use cheaper cottons wherever possible, the mill owners are very careful in the selection and mixing of the raw material. Mills spinning the finer counts prefer to buy the very best cotton even at a higher price, because of the better results to be obtained in an increased production, a better quality of yarn and cloth, and a more contented set of operatives.

PURCHASING METHODS.

Most of the cotton is bought through agents in Milan, Genoa, and Venice, although American cotton is sometimes bought direct from New York and New Orleans exporting firms. The round bale has been very popular in Italy, owing to the better protection this method of packing affords. As a rule, the condition in which American cotton reaches Italy is very unsatisfactory, and manufacturers complain generally at the loss they sustain through damaged bales.

Spinners in Italy buy cotton in large quantities and at long intervals. Purchases are made c. i. f. Genoa or Venice, and the terms of sale are usually 90 days net. The freight rate on cotton varies from \$0.35 to \$0.50 per 100 pounds, as determined by the interior point in America from which it is shipped. During last year by a special agreement with the transportation companies a rate of 30 cents from New Orleans to Genoa was obtained, but the rate in force at present is 40 cents. There is a charge for unloading at Genoa and Venice and for loading on cars. This charge is \$1.64 per ton at Genoa and \$0.67 per ton at Venice for American cotton, \$1.25 and \$0.57 per ton for Indian cotton, and \$0.868 and \$0.48 for Egyptian cotton.

Railway freight rates from Genoa to several of the important cotton-mill towns are as follows: Genoa to Milan, \$2.42 per ton; to Busto Arsizio, \$2.80; to Gallarate, \$2.87; to Bergamo, \$2.98; to Brescia, \$3.32; to Turin, \$2.51.

The actual cost of cotton often varies slightly among the various brokers or agents, as no cotton exchange is maintained. The dealer bases his price on the Liverpool market, with due allowance for freight, duty, and commission, and then makes an offer to the manufacturer. In general, the price of American cotton at the mill in

Italy is 1 to 1½ cents higher than the price in the United States for the corresponding grade and staple.

MARKET QUOTATIONS.

On September 7, 1911, the following prices were quoted by one firm for American, Indian, and Egyptian cotton, all quotations being c. i. f. Genoa:

Varieties.	Price per pound.	Varieties.	Price per pound.
	Cents.		Cents.
American middling, October delivery:		Egyptian, October delivery:	
Staple 28 millimeters (1.10 inches)...	12.68	Lower Egyptian—	
Staple 30 millimeters (1.18 inches)...	12.98	Type No. 1.....	21.75
American good middling, October delivery:		Type No. 2.....	21.40
Staple 28 millimeters.....	12.98	Type No. 3.....	21.63
Staple 30 millimeters.....	13.28	Upper Egyptian—	
Indian cotton, November–December delivery:		Type No. 1.....	19.30
Gomra fully good.....	11.94	Type No. 2.....	19.77
Gomra fine.....	12.18	Type No. 3.....	19.43
Bengal fine.....	11.60		

The price of October futures in New York on the same date was 11.38 cents.

COTTON GROWING IN ITALIAN AFRICA.

A very good quality of cotton is being obtained from the Italian colony of Eritrea, on the northeast coast of Africa. It is grown by the Association for the Cultivation of Cotton in Eritrea, which holds a concession from the Government. This company is making strenuous efforts to succeed and is employing the most improved and scientific methods of cultivation. The soil of the country is quite similar to that along the Valley of the Nile, and the cotton, though of a much whiter color, is very similar to Egyptian, the staple being about 1½ inches long. The fact that the land has been granted free and that labor is very cheap (about 10 cents per day), combined with the richness of the soil and the favorable climate of the country, has thus far brought about satisfactory results.

The total quantity raised in 1910 was slightly less than 1,000 bales, but steps are being taken to increase the area under cultivation by irrigation. The production from this land is over a bale to the acre. It is estimated that over 500,000 bales can be produced from the area susceptible to cultivation, and the company is planting additional land each year.

A great handicap up to the present time has been the lack of transportation facilities for conveying the cotton from the plains of Tessenei and the valley of the Barca to the seacoast, which has made it necessary for the company to purchase over 7,000 camels. At present the Italian Government is undertaking the construction of a railway line from the port of Massowah to Keren, a distance of 150 miles. When this road is completed it will be necessary to carry the cotton only 70 miles by camel, and it can be brought from the fields to the port in 5 days instead of 18, as at present.

The cotton seed used in Eritrea was originally brought from the United States, but the staple produced is both longer and stronger than that of cotton grown in America from the same seed. Eritrea

cotton usually brings a premium of about 4 cents above the price of American good middling. On account of the length of the staple, and also because the length may vary in each bale (due to imperfect methods of classifying and baling), the cotton must be combed in the mill to obtain satisfactory results.

Experiments have also been made in Sicily in the cultivation of sea island and other long-staple cotton, but the climatic conditions on the island, including the lack of rain from May until September, are such that the bolls do not mature until late fall, and frost usually kills the cotton before it ripens.

MILL METHODS AND OUTPUT.

In Italian mills the large amount of space provided permits an economical arrangement of machinery and a consequent saving of time and labor. The lappers are usually located in a building adjoining but entirely cut off from the card room. Twenty to thirty bales of cotton are opened at one mixing and allowed to stand for several days. The blower system of conveying the cotton to the breaker lapper is in common use, particularly in mills built in recent years.

ARRANGEMENT OF MACHINERY.

The cards are usually arranged in one or two double rows, with the drawing frames next to them; they are the regulation 40-inch revolving flat-top cards with 102, 104, or 110 flats. The operative who tends the cards usually has a helper to assist in the stripping. Three sets of drawing are usually found in the mills because a wide range of yarns is usually spun, and in the case of the finer counts three processes are, of course, advantageous.

Slubber frames usually have 80 to 100 spindles, intermediates 120 to 140, fine frames 160 to 180, and jack frames 400 to 500 spindles to the frame. Spinning frames are of the regulation English type, with a leather-covered front roller and uncovered self-weighted middle and back rolls. There are 400 to 440 spindles to the frame and at the end of each one there is a card showing the number of yarn being spun.

Wages are usually paid by the kilo of production. The speed of the spindles is from 8,000 to 8,500 on No. 20 warp yarn and from 9,000 to 10,000 on Nos. 30 to 40. Mule spinning frames have 800 to 1,000 spindles each and are used in making very soft twist yarn or very fine yarns. The use of mules is considerably less than formerly because they are more expensive to run and produce less than ring frames.

When sold to the weaving mills yarn is most frequently shipped on the bobbin, while yarn for export is put up in skeins and packed about 10 pounds to the bundle, as in England. The chief export markets for yarn are Roumania and Turkey.

As in the spinning mills a wide range of yarns is spun, so in the weaving mills a wide variety of cloths is woven. It is not unusual for a mill with 500 looms to produce at least 100 different kinds of cloth, with innumerable patterns. Attractive sample books showing the entire line of goods are made up in the spring and fall and distributed among selling agents at home and abroad.

Most of the looms are of the underpick type and are run at a higher speed than is the rule in the United States. Plain narrow looms about

30 inches wide make about 220 picks per minute, 40-inch looms run at a speed of 185, and dobbies at 160 to 170. The production of common looms averages from 75 to 80 per cent of theoretical production, and on Northrop looms, running at 175 picks per minute, the production is usually a little more than 90 per cent.

The weaving of split goods is a striking feature of Italian mills, particularly in the case of gray goods and flannels for printing. This is one of the economical methods worthy of note, by which the Italians cheapen their cost of production. The Italians have also developed the art of sizing goods heavily, thus enabling them to cater to the demands of a trade desiring cheap goods. The ingredients used in the slasher room are potato starch, china clay, and tallow.

NATURE OF OUTPUT.

While almost every known variety of cotton goods is woven in the Italian mills, the chief products are gray sheetings, dress goods for women, trouserings, and barchent. The latter is made up in a wide range of styles and has been exported to Turkey in large quantities. It is usually dyed in the piece or printed on one side, the other side being napped. It forms one of the chief cotton-goods exports, and it is also used in Italy for ladies' clothing in winter.

The dress goods manufactured are also made up in many varieties, including oxfords, zephyrs, reps, diagonals, cashmeres, and fancy dark-colored Jacquard cloths. Some of the latter are made from a mixture of cotton and wool, but more are manufactured from pure cotton, vigogna or other fancy and burred yarns being used to produce the wool effect. A good market for them has been found in Argentina and other countries.

Some other classes of goods manufactured in Italian mills besides those mentioned are ginghams (vichy), carolines, cretonne, poplin, velvets, sateens, tapestry and upholstery cloths, towels, fancy-colored bedspreads (gros de Tours), and white and colored fancy waistcoat material. In gray goods and bleached goods the chief lines manufactured are gray sheeting and drills, T cloths, domestics, prints, bleached shirtings, piqués (frequently napped slightly on one side), percales, madapolam, cambrics, and lawns. Handkerchiefs and large kerchiefs made similar to them and used as a head covering form a very important branch of the industry, and one of the largest firms produces thousands of them daily.

Many of the goods woven in the gray are bleached, dyed, or printed in a separate establishment located at some distance from the weaving mill, sometimes the property of the firm and sometimes owned by a separate company. Most of the cloth-dyeing works are equipped with both printing and mercerizing machines. Calico printing is of considerable importance and is carried on with great success. Roller printing machines from England and Germany are in use, although block printing by hand is still done. The dyeing and printing works usually pack and ship all goods to the agents or customers of the mill. Great care is exercised to see that the colors are exact matches of the samples by which the goods have been dyed, and a sample card accompanies each piece of goods from the time it is received at the works until the order is filled.

In packing colored goods each piece, after banding and binding, is carefully wrapped in a good quality of glazed paper, with a sample

of the material on the outside and with detailed marks on a label showing the kind of goods, length of the piece, etc. Cases are more largely used than bales for shipments, and they are made strong and substantial, with a metal lining when the goods are for the export trade.

SALES SYSTEM.

The sale of cloth in Italy is effected by a method different from both the English and the American system. While goods are sometimes sold through agents, the manufacturer looks to the buyer and not to the agent for payment. Large commission houses handling the product of many mills, as in the United States, are unknown in Italy. The leading firms sell direct through their own selling agents or traveling salesmen, not only in Italy, but in the Balkans and the Levant, where many companies maintain branch houses, and in South America.

In the principal cities throughout Italy there are large wholesale dealers who buy direct from the mill. In the case of colored goods the cloth is sometimes sold in the finished state, but frequently the gray goods are bought by the wholesaler and sent by him to the dyer or finisher to be bleached, colored, or printed as he desires. There is a considerable concentration of the cotton-goods trade in Milan and, to a less extent, in Turin.

As regards the foreign markets, there is perhaps less direct selling than at home, the goods being handled through export agents or through London and Hamburg houses who have agents in Italy. For instance, goods shipped to British India are exported chiefly through British houses. A large part of the yarn manufactured in Italy is, of course, used by the weavers, to whom it is sold direct, while the exports of yarn are sold through agents in foreign markets and through shippers in Milan, Genoa, and Venice. There is no so-called yarn market or yarn bourse, and spinners and weavers get together and agree on prices. The Cotton Manufacturers' Association, however, keeps a record of the sales made each week, quantities, prices, qualities, etc., and from these figures the average price of the several numbers is calculated and a list of these prices is printed and distributed among the members.

YARN QUOTATIONS.

The following are the present (September, 1911) prices of yarns in general use:

Kinds.	Price per pound.		Kinds.	Price per pound.	
	First quality.	Second quality.		First quality.	Second quality.
SINGLE.					
Indian, No. 12 warp and filling.....	<i>Cents.</i> 19.6 to 20.4	<i>Cents.</i> 17.9 to 18.5	American—Contd.: No. 38 warp.....	<i>Cents.</i> 25.8 to 26.7	.....
American: No. 16 warp and filling.....	20.8 to 21.7	20.6 to 21.4	No. 44 filling.....	24.9 to 25.7	.....
No. 24 warp and filling.....	22.4 to 23.1	22.0 to 22.9	TWO FLY.		
No. 28 warp and filling.....	22.8 to 23.6	.....	Indian, No. 12.....	21.7 to 22.5	.....
No. 34 warp.....	25.3 to 26.2	.....	American: No. 24.....	24.3 to 25.2	.....
			No. 32.....	25.7 to 26.6	.....
			No. 40.....	27.3 to 28.2	.....

Prices are f. o. b. the yarn mill and 2 per cent discount is allowed if payment is made in 30 days. The terms of sale of both yarn and cloth are usually 3 months, although there is no fixed rule, and the buyer and seller frequently agree on longer terms.

The rules governing home sales of both yarn and cloth are given below. These rules were adopted by the Italian Cotton Manufacturers' Association several years ago, and are generally observed by the mills.

CONDITIONS FOR THE SALE OF YARN.

1. For variations in the weather there shall be an allowance of 1 per cent. By net weight is understood the weight of the yarn after deducting packing.

2. When the sale is by package each package must contain 4,500 grams of yarn, net, and any variation from this must be made good after making an allowance of 1 per cent as above.

3. The tare allowance for bobbins must not exceed 3 per cent for filling and 2 per cent for warp. Any excess above these amounts must be made good, except when otherwise specified by mutual agreement between the buyer and seller.

4. By the number of the yarn is understood the number of skeins of 840 yards contained in 1 English pound, except when a different system of numbering has been mutually agreed upon. A variation of 2 per cent from the stated number is permissible, but a variation of 5 per cent entitles the purchaser to the right to refuse the yarn. In testing for the number, seven bobbins from each case shall be weighed, provided the yarn has the normal amount of humidity (8 per cent).

5. The number of twisted yarn shall be determined by the number of the single yarn which has been twisted, due allowance being made for contraction. The contraction of dyed or bleached yarns, single or ply, is to be determined on the basis of the corresponding single gray yarn as regards number and weight.

6. If the buyer notifies the seller that the yarn is not up to the contract and the seller continues to ship the same kind of yarn, the purchaser may cancel the contract and be reimbursed for any damages he may have sustained by the failure of the spinner to deliver the yarn as called for in the contract.

7. Claims as to quality must be filed in 15 days, and claims as to weight within 5 days, after the arrival of the yarn. Claims regarding "hidden defects" must be filed within 3 months.

8. If the yarn is not delivered at the time stated in the contract the buyer shall, by means of a registered letter or telegram, grant 5 days of grace to the seller. At the expiration of 5 days after forwarding the letter or telegram, if the yarn is not delivered the purchaser may cancel the contract, except when the failure to deliver is due to extraordinary causes beyond the control of the seller.

9. Extraordinary causes shall comprise floods, dryness of the rivers or canals which furnish power, accidents to the steam engine or other driving system, and strikes of not over 45 days' duration. Failure to deliver for any of these causes does not entitle either the seller or purchaser to cancel the contract, but shall only postpone the filling of the order.

10. In case the mill or mills of either buyer or seller should be destroyed by fire so as completely to stop consumption or production, or even curtail it, during a period of 3 months, either party may cancel the contract, but the party which benefits by such a cancellation must indemnify the other party if he has suffered damages, the matter being submitted to arbitration for decision.

11. Unless otherwise specifically stated in the contract, the following shall be the terms of sale; (a) Discount at 2 per cent; (b) payment in 30 days; (c) interest for deferred payments at 6 per cent per annum; (d) freight to be paid by the buyer; (e) delivery in installments shall be distributed over the number of the months that intervene between the first and last dates mentioned in the contract; when only the date of the first delivery is specified, it is understood that shipments shall be made over a period of 6 months; (f) empty cases are to be returned to the seller freight paid or be paid for at their cost price; (g) the rules for settling disputes and for submitting to arbitration as adopted by the cotton association are to be mutually agreed to.

12. When yarns are ordered for delivery on a certain date and the purchaser does not give the seller shipping instructions, on that date the seller is entitled to interest charges after proper notification, by registered letter, has been given to

the customer. If the latter still fails to furnish shipping instructions, the seller is entitled to cancel the contract and to recover damages for any loss sustained.

13. When the yarn is ordered for prompt delivery shipment must be made within 15 days from the date of sale. If shipment during the month is specified the delivery may be made at any time during the month as suits the convenience of the seller, but in case the order is for delivery by installments during the month shipments must be made during each week in the month.

14. When the contract reads "delivery when called for," the seller gives the purchaser the right to dispose of the yarn according to his wants within the time stated, but shipping instructions must be furnished 30 days in advance of delivery, and the seller can not be compelled to deliver the yarn in one-quarter (or less) of the time stated in the contract.

15. Settlements must be made at the seller's place of business unless otherwise provided for, and payment must be in legal tender or promissory notes which are acceptable to the buyer. Interest on notes must be at the rate of 6 per cent per annum, and the purchaser must pay any charges incurred in negotiating same. Failure to pay notes when due entitles the seller to defer shipments.

CONDITIONS FOR THE SALE OF CLOTH.

1. In gray goods yarns must be stated according to the English system of numbering, and the number of threads must be given per centimeter or quarter inch. By quarter inch is understood a quarter inch French (1.0936 inches), unless otherwise stated.

2. In the shipment of gray goods the following allowances will be made: (a) Three per cent, more or less, upon the amount of the shipment when it does not exceed 2,000 pieces, 2 per cent on shipments between 2,000 and 5,000 pieces, and 1 per cent on shipments of more than 5,000; (b) 4 per cent upon pieces of varying width; (c) if in the contract the length of pieces is indicated by one figure, the advantage of regular width is to be accorded to pieces which do not vary more than 3 per cent from the indicated number; if the length is indicated by two figures, the allowance must be calculated on the average length; (d) 1 per cent on the width of goods; (e) upon the average weight of every shipment an allowance of 2 per cent based on the theoretical weight and an allowance of 5 per cent on single pieces; if the average weight of the total shipment exceeds this allowance by more than 1 per cent, other goods must be substituted.

3. Claims on the quality and weight of the goods must be made within 15 days from the receipt of the shipment, except in the case of "hidden defects." Claims on the latter must be filed within 2 days after they have been discovered.

4. Total or partial failure on the part of the seller to deliver the goods within the time stated in the contract entitles the purchaser to cancel that part of the contract covering the portion of goods undelivered and to claim damages for any loss sustained, the amount to be determined by arbitration. In such cases the buyer must give notice to the seller, by registered letter, not less than 15 days previous to the filing of the claim.

5. The right to claim under the preceding article is not allowed in so-called cases of "superior force." These causes are floods, extraordinary droughts in rivers or canals, breakage of principal machinery or transmission, strikes of not more than 45 days, or suspension of railway service. None of these causes can be claimed by either party to the sale as ground for the cancellation of a contract, but only for the postponement of delivery.

6. If the plant of either the buyer or seller is destroyed by fire or other cause beyond the control of the owner, rendering either party incapable of receiving or delivering the goods contracted for and such a condition obtains for a period of three months, the contract may be canceled. If the party which is still able to carry out the contract suffers a loss by reason of the cancellation, the parties may resort to the judgment of arbitrators to fix the amount of the indemnity.

7. Unless otherwise specifically stated in the contract the following terms of sale are mutually understood: (a) Goods to be marketable; (b) discount at 2 per cent; (c) payment in 30 days; (d) interest on deferred payments at 6 per cent per annum; (e) shipment to place of delivery at the risk of the buyer; (f) shipments to be made in installments in number equal to the number of months intervening between the first and last dates of delivery as stated in the contract; if the date of the termination of shipments is not stated it is understood that the contract is to run for six months; (h) the compromise clause as set forth in the standard contract in use by the members of the cotton associa-

tion and the application of similar special regulations in regard to arbitration are understood.

8. If the buyer does not take the goods within the terms of the contract the seller is entitled to cancel that part of the contract not filled (provided 15 days' notice has been given to the buyer by registered letter or wire) and to be reimbursed with the difference between the price named in the contract and the market price of the same goods at the time of the termination of the contract, or he may sell in the open market one or more of the qualities of textiles named in the contract.

9. When delivery during the month is specified the seller may make shipment of the goods at any time during the month which best suits his convenience.

10. Settlements must be made at the office of the seller unless otherwise specifically stated, and must be in legal tender. The contracting parties, for the purposes of the contract, will consider the residence of the seller as their legal domicile in the absence of other special provisions.

11. The seller may suspend shipments under any and every contract in case payments are not met at the time specified in the contract unless other arrangements are specifically provided for. In the absence of any special provision, the buyer who is slow in meeting payments will not be entitled to recover damages.

In the case of domestics the foregoing rules apply with the exception of articles 1 and 2e and the allowance mentioned in 2a, because it is customary to ship these goods in the exact quality and quantity contracted for.

LABOR CONDITIONS.

Women form the largest proportion of operatives in Italian cotton mills. The employees in the industry in 1910, by classes, were as follows.

Classes.	Males.	Females.	Total.
Adults.....	53,454	56,890	110,334
Children, 12 to 15.....	9,238	27,634	36,872
Girls, 15 to 21.....		60,106	60,106
Total.....	62,692	144,620	207,312

Generally speaking, men are employed on lappers, cards, slashers, and in the dyeing and finishing departments, and women on drawings, combers, roving frames, spinning frames, reelers, warpers, and in the cloth rooms for inspecting and folding cloth (by hand). In the weaving rooms both men and women are employed, but the latter are greatly in the majority.

EFFICIENCY OF OPERATIVES.

The efficiency of the Italian operative is much lower than that of the American or English worker, and the large number of employees impresses an American on entering a cotton mill in Italy. The average number of operatives per 1,000 spindles in a yarn mill is from 7 to 10. In the lapper room 1 man is required for each machine; card operatives usually tend from 8 to 12 cards and in exceptional cases 15; 1 woman or girl runs 12 to 18 deliveries of drawing; 1 operative to each slubber, intermediate, or fine frame is the rule. Spinners tend 2 to 3 sides of 200 or 220 spindles each. Twenty to 40 spindles per girl is the rule in the spooling and winding depart-

ments, and 1 woman tends 1 beam warper. One man and a helper are employed for each slasher. In the weaving room 1 operative usually runs 2 or 3 plain looms or 10 to 12 Northrop looms. In spinning mills there is generally 1 director or superintendent, with an overseer in each department. The same system prevails in the weaving mills, with section men looking after 40 to 60 looms each.

AVERAGE WAGES.

Wages vary in different localities, being higher in the cities and lower in the country districts. The following table, giving a low and a high daily wage scale, was made up from my own investigations and from information furnished by the Cotton Manufacturers' Association:

Employees.	Low.		High.	
	Lire.	American currency.	Lire.	American currency.
Scutchers (men).....	2.25	\$0.434	3.50	\$0.675
Carders (men).....	2.50	.482	3.50	.675
Combers (women).....	2.00	.386	2.50	.482
Drawing frames (women).....	1.50	.289	2.25	.434
Slubbers (women).....	1.50	.289	2.25	.434
Intermediates (women).....	1.50	.289	2.50	.482
Fine frames (women).....	2.00	.386	3.00	.579
Spinning frames (women).....	1.50	.289	2.50	.482
Mule spinning (men).....	3.50	.675	4.50	.868
Spoolers (women).....	1.50	.289	2.50	.482
Reelers (women).....	1.50	.289	2.50	.482
Warpers (women).....	2.00	.386	2.50	.482
Slashers (men).....	4.50	.868	6.00	1.158
Drawing-in hands (women).....	1.50	.289	3.00	.579
Weavers (men).....	2.00	.386	4.00	.772
Weavers (women).....	1.50	.289	3.00	.579
Dyeing and finishing (men).....	2.00	.386	5.00	.935
Miscellaneous labor.....	2.00	.386	3.00	.579
Machinists.....	4.00	.772	6.00	1.158
Loom fixers.....	4.00	.772	6.00	1.158
Overseers.....	5.50	1.062	7.00	1.351

While the actual wages earned by the Italian operatives are much less than are paid to mill workers in the United States, the efficiency of the latter is considerably greater. For example, a spinner in Italy tends only 3 sides of spinning, but the frames are long (220 spindles to the side). In the United States an operative tending 10 sides of, say, 124 spindles each earns about \$1.25 per day. The Italian operative receives from 45 to 50 cents per day for tending 660 spindles, hence the actual cost of production on spinning frames is nearly as high as in the United States.

VARIATION IN WAGES.

Wages in Italy are somewhat higher than they were 10 years ago, owing not only to the growth of the industry and the consequent increased demand for labor, but to a series of strikes among the laborers in Lombardy and Piedmont in 1905 and 1906, as a result of which the operatives gained a substantial increase. However, the higher wages have been accompanied by increased efficiency among the workers, and it is doubtful if the cost of production has appreciably risen.

The rapid advance of the industry has also created a demand for well-trained men for overseers, superintendents, and managers. Excellent textile schools are maintained at Milan, Biella, and Turin, where the students receive the highest technical training, and these men easily find places in the industry after completing the course of study. Some of them also go to more advanced schools in England or Germany, and become competent managers in spinning, weaving, and printing establishments.

As the finer qualities of goods are manufactured in Piedmont, wages there are generally higher than in Lombardy and in southern Italy, where the supply of laborers is greater than in the north. Local conditions also have an important bearing on the scale of wages. For example, operatives in the cotton mills at Chieri, a town near Turin, probably earn more than those in any other part of Italy, owing to the fact that the town is an important center of hand-loom weaving, and it was necessary to offer high wages to attract the people to the mills. Some of the most skilled hand-loom weavers at Chieri often earn 5 lire (\$0.965) per day.

The wages in the preceding table are by the day, but roving and spinning frame hands and weavers are generally paid by the piece. On a flannelet, for example, the weaver is paid 1.50 lire (28.9 cents) per piece of 50 meters (54.68 yards), or 0.529 cent per yard. The goods are woven 140 centimeters (55 inches) wide and split in two. The cloth has 32 picks per inch and the loom speed is about 160. On plain sheetings of the same width as flannelet, but with 68 picks, the price for weaving is a little less than 1 cent per meter. On 48-pick goods 30 inches wide and a loom speed of 200 the price is 60 to 70 cents per 110 meters (120.3 yards).

In some of the mills the employees are paid a bonus in addition to the regular wages if the production exceeds a certain fixed amount. Wages are usually paid every two weeks, on Saturday.

WORKING HOURS—FEMALE AND CHILD LABOR.

There is no general law in regard to hours of labor in cotton mills, but women and children are forbidden to work at night; children under 15 can work only 11 hours per day and women only 12. In practice the mills have adopted a 10, 10½, or 11 hour day. Work usually starts at 6.30 a. m. in summer and at 7 in winter. One and a half to two hours are usually allowed at midday, from 12 to 1.30 or 2 p. m. The mills run until 6.30 or 7 p. m.

Italian laws afford full protection to women and children employed in cotton mills and are, in some respects, in advance of American factory legislation. The following are some of the main provisions of the law.

Children under 12 are forbidden to work.

When a child applies for work his age must be certified to by his parents and by the mayor of the town in which he lives.

Girls under 21 and boys under 15, when applying for work, must have a health certificate signed by a medical officer or physician, stating that they are physically able to work, and each child must be vaccinated before entering the mill.

An educational qualification requires that every child must have had an elementary school course, which fact must be certified by the

school he attended. The usual requirement is six years, but in case the child has had only three years, he is sometimes allowed to work out of the school season, provided he takes the three additional years immediately after entering the mill. Failure to secure promotion in school after one year deprives the child of the privilege of working.

Each boy up to 15 years and each girl up to 21 is subject to these provisions, and small books are furnished which contain the certificates, duly signed, covering all these points. The book is kept by the employee and must be presented at the mill when he or she applies for work.

Children are not allowed to clean motors, gearing, or machinery in motion.

Women must have 2 hours' rest after 6 consecutive hours of work and a weekly rest of at least 36 hours. The law forbids the employment of women for 1 month after confinement and requires that in factories employing more than 50 operatives a nursery must be provided and mothers must be allowed one-half hour to one hour in addition to the noon rest to nurse their babies.

In addition to the medical examination and health certificate prescribed for children before being employed, a periodical visit to the mill must be made by a medical officer to ascertain if the boys under 15 and the girls under 21 are physically fit to work, and the mill premises and workers' houses must be regularly inspected by a sanitary officer.

It is generally conceded that these laws are being observed by the manufacturers, and this was also the opinion of the inspector of labor of the Piedmont region with whom I talked. Four general inspectors for the industrial centers are employed by the Government, and heavy fines are imposed on mill owners who violate the provisions of the law.

EMPLOYERS' LIABILITY—OLD-AGE INSURANCE.

In addition to the foregoing there is a law in regard to accidents to employees. The employer is required to use every precaution for the prevention of accidents, and inspectors have full authority to force the mill owners to provide the necessary means for safeguarding employees.

The amount of compensation to be paid in case of accident is as follows:

In case of death, five times the annual wages of the deceased must be paid to his heirs or dependents.

For total incapacity as a result of accident, the employee must be paid six times the amount of his annual wages, and in no case less than \$600.

For partial disability the employee must be paid six times the amount by which his wages are decreased as a result of the accident, and this amount may be paid either in annual installments or in a lump sum by mutual agreement.

If a workman is temporarily incapacitated, one-half of his daily wages must be paid to him up to a period of five days, when a smaller amount is paid.

Employers may insure their workmen in an accident insurance company, but this does not free them from liability if the accident is due to negligence on their part, and the injured employee may recover from the employer the amount due him in excess of the sum paid by the insurance company.

All the laws relating to work and accidents must be printed and posted conspicuously in the mill.

In addition to the protection afforded by these laws the Government of Italy also provides a system of old-age pensions, of which many of the cotton-mill operatives have taken advantage. All workers can insure, under the provisions of this law, by paying from \$1 to \$20 per year, the amount of the pension depending on the size of the premium. Payments of pensions begin at the age of 60 or 65 in the case of men and at 55 or 60 in the case of women. In case of death of the insured, the premiums paid in are turned over to the heirs of the deceased. If illness or accident permanently incapacitates the workman, the pension begins at once.

It is not unusual for the employers to assist their operatives in the payment of their premiums, and in the case of one mill which I visited the proprietor was paying the entire premium for his employees.

HOUSING OF OPERATIVES.

While the standard of living among Italian cotton-mill operatives is lower than that prevailing in the United States, it is much higher than 10 years ago. This is due in large measure to the welfare work which the owners of many mills have taken up. It is not unusual to find a cotton mill provided with good bath houses, a gymnasium, reading room and clubroom, and, sometimes, a moving-picture show or theater at which a small charge is made. Good schools are a part of the regular equipment.

Mills built in recent years have their own tenements for operatives, which are divided up into suites of two, three, and four rooms each. Where the mill owns the houses, rents are usually lower, being about 3 or 4 lire (\$0.57 or \$0.77) per room of 20 square meters (186 square feet) per month. The monthly rent of houses for workers is \$0.77 to \$0.96 per room in Busto Arizio; \$0.96 to \$1.25 in Monza; and \$0.86 to \$1.15 in Lagnano and Brescia.

Separate houses for operatives, which are the rule in the United States, are not usually found in Italy, except in the smaller towns where the supply of tenements is insufficient. In such cases the cotton manufacturers have built two and three room cottages which rent for about 40 cents per room per month.

It frequently happens that the employees of Italian cotton mills live at some distance from the factory, and in such cases the owners usually build and maintain boarding houses for the women and girls, who make up such a large proportion of the operatives. Many of these houses are under the supervision of nuns, and they are clean and well kept. Separate beds are provided in a large dormitory, and there are usually recreation rooms and sitting rooms in the building. Good substantial meals are served in a common dining room, and the charge for board and lodging is extremely low, ranging from 8 to 10 cents per day. The boarders usually go to their homes, at some distance from the mill, for the week end.

VARIETY AND COST OF FOODSTUFFS.

The Italian operative does not have a great variety of food, but what he eats is substantial and nourishing. The diet consists mainly of soup and vegetables; fresh meat is seldom eaten, except on Sundays and holidays. For breakfast, bread and cheese or salami (salt meat) are usually eaten. Dinner is the most important meal, and consists of minestra (thick soup made with macaroni), rice or other vegetables, and grated cheese. Green vegetables and fruit are also served. For supper the operative has minestra or polenta (a kind of corn-meal mush), the latter being sometimes mixed with chestnuts. Light wine is used universally as a beverage, and a fairly good quality can be purchased at 8 to 10 cents per quart, being cheapest in Piedmont and Tuscany, where it is most plentiful.

The price of various commodities in several of the important cotton-mill centers is given in the following table:

Articles.	Callarata.	Turin.	Monza.	Bergamo.	Como.	Milan.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Wheat bread.....pound..	3.76	3.33	3.50	3.85	3.32	3.28
Wheat and corn bread.....do..	3.60	-----	3.06	2.63	2.80	2.67
Pure corn bread.....do..	2.19	-----	1.84	-----	-----	-----
Wheat flour.....do..	3.85	3.85	4.30	4.02	3.94	3.94
Corn meal.....do..	2.19	2.45	1.75	1.92	2.19	2.10
Rice.....do..	3.94	4.39	4.28	3.94	3.94	3.60
Beans, dried.....do..	3.94	3.32	4.81	-----	4.38	3.50
Macaroni for soup.....do..	5.25	4.80	5.25	4.73	5.25	4.99
Potatoes.....do..	1.31	1.75	1.31	1.31	1.31	1.81
Beef.....do..	14.88	15.76	15.76	15.76	15.76	11.38
Pork.....do..	19.26	17.51	18.38	17.51	17.51	21.61
Fish, dried.....do..	6.56	8.75	8.31	8.36	7.00	6.56
Codfish.....do..	11.88	14.76	9.63	11.28	-----	12.26
Lard.....do..	14.01	13.13	13.13	14.88	15.76	13.13
Butter.....do..	25.39	29.76	29.76	29.76	30.64	31.51
Sugar.....do..	14.01	13.13	14.01	14.01	14.01	13.13
Coffee (Porto Rico).....do..	43.77	39.39	43.77	43.77	43.77	39.39
Eggs.....dozen..	16.40	16.79	16.40	23.16	28.16	23.16
Kerosene.....gallon..	29.22	26.27	36.53	35.05	29.22	29.22
Wood (for fuel).....100 pounds..	30.62	50.76	48.13	43.77	-----	35.02
Coal.....do..	43.77	47.36	43.77	42.98	43.77	43.77

By means of cooperative stores, which are numerous in Italy, the operatives are often able to buy their food supplies at prices lower than those given in the foregoing table. These stores have been established in practically all the cotton-mill towns in Lombardy and Piedmont, and they play a large part in the life of the working classes.

TRADE AND LABOR ORGANIZATIONS.

The relations between the employers and employees in the Italian cotton industry are good. While the spirit of trade-unionism has grown in Italy in recent years, there is no strong organization among the operatives. As a rule the existing unions confine their activities to obtaining shorter hours and better working conditions. There are really two organizations among the textile workers—the Federazione Arti Tessili and the Syndicato Italiano Tessili. The former is of a socialistic nature, and in 1910 consisted of 80 sections, or unions, with 9,491 members. The syndicato is a religious organization, and its membership was 6,037 in 1910. The total number of members in both organizations (15,528) is thus rather small as compared with

the total number of cotton-mill operatives (207,000). However, the total number of adult male operatives, from whom the membership is drawn, is only slightly more than 50,000, and in the strikes of five and six years ago the unanimity of action and the allegiance of the members secured many concessions from the manufacturers and inspired more confidence in the organization.

The welfare work of the mill owners—their interest in the operatives and provision for the latter's comfort, amusement, and pleasure—has done much in the past few years to bring the employer and employee into closer and more friendly relations, and it is becoming easier each year amicably to adjust any disputes or differences without resort to strikes.

The manufacturers have not formed any regular organization specifically to deal with the trade-unions, such combinations among them having always been temporary and due to the necessities of the occasion. The only manufacturers' organization is the *Associazione Cotoniera Italiana*, which has already been mentioned and which occupies an important place in the industry. The headquarters of the association is in Milan, where the manufacturers meet and discuss their interests and the problems confronting them. The association is really made up of four sections, devoted, respectively, to spinning, weaving, finishing, and raw cotton, and the members pay in proportion to the number of their operatives. Each section has a directorate of 3, making 12 directors for the four sections, to which are added 6 directors selected by the association as a whole. These directors form the governing body of the organization and elect the officers.

TREND OF INDUSTRY IN RECENT YEARS.

The statement of a prominent cotton manufacturer that there was a loss of 3 cents on every pound of cotton goods sold in Italy last year indicates that the industry here has shared in the world-wide depression also felt so keenly by the manufacturers in the United States. There has been a cessation in the building of mills, except in the south, where the inducements and encouragement offered by the Government, as already mentioned, and the desire of southern Italy to become industrially independent, have slightly stimulated the building of factories.

While the export trade has grown in recent years, the domestic market is oversupplied, and the stock of yarn and cloth at the end of 1909 was greater than ever before. During 1910 the stocks were decreased, owing to the policy of curtailment which was practiced, but practically all the mills are now (October, 1911) running full time, and there is no marked increase in the demand for cotton goods.

Italian merchants purchase a large supply of goods at one time, and during 1907, 1908, and 1909 they laid in heavy stocks of goods, which they were unable to sell. Poor crops caused a lighter demand for goods and this aggravated the troubles of the mill owners. The crisis became so acute in 1909 that the manufacturers reached an agreement to curtail production 25 per cent, and another plan of short-time running was adopted in December, 1910. A number of the mills suffered considerable losses, and the prices of shares declined. Some of the mills failed, while others were forced to liquidate or sell out.

The following figures, relating to three mills in 1907, 1908, 1909, and 1910, show the effect of the crisis in the industry :

	Mill No. 1.	Mill No. 2.	Mill No. 3.
Capital.....	\$720,000.00	\$386,000.00	\$115,000.00
Par value of shares.....	48.25	48.25	38.60
Market value of shares Sept. 5, 1907.....	67.94	58.86	44.79
Market value of shares Dec. 31, 1908.....	55.97	36.67	25.00
Market value of shares Dec. 31, 1909.....	53.50	27.02	Failed.
Market value of shares Dec. 31, 1910.....	47.28	Failed.	.....

CAUSES OF DEPRESSION—EXPORT TRADE POLICY.

One reason given for the unsatisfactory condition of the industry is that the banks have ceased to offer the liberal credit terms formerly allowed. It was stated that because of the great losses sustained by many manufacturers in 1910 through the bills of lading incident in the United States the banks have drawn a tighter rein on their loans to cotton mills. As Italy is preeminently a country of long credits, it is difficult to carry on business successfully without liberal credit. When the banks refused to loan to the spinners the spinners were forced to curtail their credit to the weaving mills or shut down their plants, and the weavers in turn were not able to offer the old-time terms to the dealers. The result was general disturbance in the industry and trade. Some manufacturers seem to think that the falsifying of bills of lading in the United States has worked great harm on the business, aside from the money loss involved, and that the effects will be felt for years.

Another matter of much concern to the Italian manufacturers is the war with Turkey. Exports of cotton goods to European and Asiatic Turkey in 1910 amounted to nearly \$8,500,000, or more than 30 per cent of the total exports of cotton manufactures and the loss of this market would be severely felt.

The fact remains, however, that Italian mills are built and operated on strictly modern lines, embodying all the improvements known to the industry. Economies are attained through the weaving of split goods, the use of cheaper cottons and heavy sizing, an economical system of management has been adopted, labor is perhaps cheaper than it is in other manufacturing countries, an aggressive policy as regards export markets has been inaugurated, and every effort is being made to secure an increasing share of the world's cotton-goods trade, particularly in South America, the Levant, and, quite recently, in China. These methods and policies have brought the industry in Italy to the position which it holds to-day, and the exports of cotton goods for the first six months of 1911 were greater than for any previous corresponding period, amounting in value to nearly \$20,000,000.

PROMINENT MILLS.

Statistics of the number of spindles or looms in individual mills are not obtainable, as already mentioned, the mill owners being reticent about giving out figures. There are several directories of the Italian cotton industry, but they give only the names and locations of the factories and a general idea of their products.

Some idea of the size and importance of the cotton mills may be gained from the following table showing the capital of the principal companies, the normal value of the shares, their high and low market value in 1909, and dividends paid in recent years. The dividends are stated in lire per share.

	Capital.	Par value of shares.	Market value of shares, 1909.		Dividends.		
			High.	Low.	1907	1908	1909
	<i>Lire.</i>	<i>Lire.</i>	<i>Lire.</i>	<i>Lire.</i>	<i>Lire.</i>	<i>Lire.</i>	<i>Lire.</i>
Tessuti Stampati.....	23,000,000	250	297	255	20.00	17.50	15.00
Cotonificio Ligure.....	12,000,000	100	92	70	10.00	7.00	5.00
Cotonificio Valle di Susa.....	10,000,000	250	(¹)	(¹)	17.50	17.50	17.50
Cotonificio Veneziano.....	9,800,000	175	232	160	17.50	14.00	7.00
Cotonificio Cantoni.....	8,000,000	250	522	368	27.50	25.00	17.50
Cotonificio della Valle Seriana.....	8,000,000	250	402	327	27.50	25.00	15.00
Manifattura Tosi.....	8,000,000	250	361	252	20.00	18.00	15.00
Cotonificio Val d'Olena.....	7,000,000	200	230	204	18.00	14.00	10.00
Manifattura Festi Rasini.....	6,400,000	250	(¹)	(¹)	17.50	17.50	12.50
Manifattura Rossari e Varzi.....	6,000,000	250	341	270	27.50	22.50	15.00
Manifattura Rotondi.....	6,000,000	250	(¹)	(¹)	25.00	25.00	17.50
Cotonificio F. Turati.....	6,000,000	250	(¹)	(¹)	20.00	12.50	-----
Cotonificio Furtër.....	5,000,000	250	260	190	20.00	12.50	-----
Cotonificio Valle Ticino.....	4,000,000	200	285	220	20.00	20.00	12.00
Cotonificio di Trobaso.....	4,000,000	200	180	142	15.00	8.00	-----
Società Anon. Introlini.....	3,000,000	200	(¹)	(¹)	18.00	18.00	12.00
Cotonificio Cova.....	2,600,000	250	360	331	21.25	17.50	17.50
Cotonificio Verbanese.....	2,500,000	200	200	192	15.00	12.00	9.00
Cotonificio Venzaghi.....	2,500,000	100	(¹)	(¹)	12.00	8.00	8.00
Cotonificio Dell'Acqua.....	2,000,000	100	(¹)	(¹)	6.00	4.00	7.00

¹ Not quoted.

TESSUTI STAMPATI.

The Società Italiana Ernesto de Angelli per l'Industria dei Tessuti Stampati, which operates mills in Milan, Legnano, Crusinallo, Ponte Nossa, and Aglie Saronna, is the most important firm in the industry. It has 100,000 spindles, 4,300 looms, and 46 printing machines, and employs 7,000 operatives. Originally this firm was engaged in the printing business alone, buying most of its cloth from England. The tariff law of 1887 so successfully stopped the importation of cotton goods that it was necessary to purchase the cloth in Italy. The quality of the home product proving unsatisfactory, the company erected its own weaving mills, and later, in order to secure a better grade of yarn, took up spinning. The company engraves its own copper rollers for printing, and many of them require highly skilled engravers. Block printing is also carried on, especially in the printing of handkerchiefs and head covers, a large quantity of which are produced by its mills. One of the specialties of this firm is printed flannelets and barchent.

COTONIFICIO CANTONI.

The Cotonificio Cantoni, with mills at Castellanza, Legnano, Besozzo, and Bellano, operates 140,000 spindles and 3,500 looms. In the mill at Castellanza there are 50,000 spindles and 900 looms, 350 of the latter being Northrop looms, of Swiss manufacture. Altogether the firm uses about 4,000 electric horsepower, which costs about

120 lire (\$23.16) per horsepower per year, and employs 5,000 operatives, and its total product is over 12,000,000 pounds annually.

In the spinning department of the Castellanza mill each spinning frame of 440 spindles is driven by a separate motor of 8 horsepower. The machinery is cleaned by compressed air, and, altogether, the mill is one of the best equipped in Italy. A wide variety of fabrics is made, but shirtings, bleached goods, piqués, and fancy white goods are the principal products.

The daily wages in the card room are 3 to 3.50 lire (57.9 cents to 67.5 cents) for men, and women earn 2 to 2.50 lire (38.6 to 48.2 cents). Spinners running three sides of 440 spindles each make 2.50 lire (48.2 cents) per day. Weavers tending two plain looms earn 2 lire (38.6 cents) per day, while on Northrops the wages are 3.50 to 4 lire (67.5 to 77.2 cents) and each operative runs from 8 to 10 looms.

One of the chief products of the mill is madapolam, and on a fabric of this kind made of 96 picks of No. 38 yarn in the warp and 104 picks of No. 50 yarn in the filling (to the inch) the operative is paid 3.50 lire per piece of 110 meters (0.563 cent per yard), and the loom production is about 25 yards per day.

COTONIFICIO VALLE DI SUSA.

The Cotonificio Valle di Susa operates one mill in Turin with 30,000 spindles and 500 looms, one in Santonino with 52,000 spindles, one in Borgone with 32,000 spindles, and another in Bussoleno with 30,000 spindles. The mill in Turin is of one-story brick construction and is equipped with sprinklers and humidifiers. Steam power is used for driving and it costs 125 lire (\$24.12) per horsepower per year, according to the engineer. Eight hundred operatives are employed, of which some 80 per cent are women.

In the lapper room the blower system for conveying the cotton is used. Two operatives at 3 lire (57.9 cents) per day tend one opener and two finishers. There are 48 revolving flat cards, of English make, with 96 flats each. Card hands were running 12 cards and earning 3 lire (57.9 cents) per day, and two strippers were employed at the same wages as the card operatives. Drawing-frame hands were tending 6 deliveries of drawing and 2 ribbon lap machines, and their daily wages were 2.50 lire (48.2 cents). One operative was running 8 heads of Heilman combers and earning the same wages as drawing-frame hands. On the slubbers of 80 spindles each, intermediates of 112 spindles each, and fine frames of 142 spindles each the operatives were paid 2.20 lire (42.4 cents) for running one machine, and on jacks of 162 spindles each 2.60 lire (50.18 cents) per day.

In the spinning room 22,000 of the spindles are mules and 8,000 ring spindles. The ring spinning frames have 400 spindles each and each spinner tends two to three sides and is paid at the rate of 0.70 lira (13.51 cents) per side. The mule frames have 800 to 1,000 spindles each and one man at 4.75 lire (91.67 cents) and four boys at 2 lire (38.6 cents) per day were tending two mules. Operatives on spoolers and reels were earning 2.50 lire (48.2 cents) per day. The mill manufactures yarn for the market in addition to supplying its own looms, the range of numbers being from 20 to 100. Egyptian cotton is used for the higher counts.

COTONIFICIO LEUMANN.

The Cotonificio Leumann at Borgata Leumann, near Turin, is one of the model mills of Italy from every standpoint. It is a private concern operating weaving only, with a warp preparation department and a dyeing department. There are 1,100 looms in the mill and 1,300 operatives are employed. A 700-horsepower engine is used for driving and the cost of power is very low, being only 75 lire (\$14.47) per horsepower per year. Practically all the looms are of Swiss make and are equipped with Jacquards.

This mill makes a specialty of cotton trouserings and dress goods [samples showing kind of goods manufactured are filed in the Bureau of Manufactures], and it exports these to South America and other countries. In some of the goods stripes of artificial silk are used. A considerable quantity of reps is woven, also cottonades and leno fabrics made in imitation of wool through the use of special yarns.

The wages in this mill are higher than in any other mill I visited, and the operatives are of a superior class. Everything possible is done to stimulate the workers to improve their condition. This policy is particularly emphasized in the village in which the mill is situated and which would be called a "model mill village" in the United States. No pains have been spared by the proprietor to provide for the welfare and contentment of the operatives, in whom he seems to take a personal interest. I found that a number of the operatives lived several miles from the factory, but were carried to and from their work each day by a special train.

For the girls who desire to remain in the village during the week, returning to their homes on Saturday, a boarding house has been provided which is perfect in its appointments. There are accommodations for 250 girls. The beds are clean and comfortable; three meals are served daily, and the charge for board and lodging is 0.45 lira (8.68 cents) per day. Attractive cottages have been erected, nearly every one different in design and architecture, and provided with electric lights and running water. The houses are built with suites of two, three, and four rooms each, but each suite is entirely separate and independent. The rent is usually 80 cents per room per week.

Kindergartens, elementary schools, and night schools are provided by the proprietor, and there is also a domestic science school for girls. There is a cooperative store in the village, and the firm gives the room and light rent free. Free medical attention is given to the operatives who are sick, and a library, club rooms, shower baths, and a theater are provided. In fact, there is every conceivable provision for the physical and moral welfare of the operatives, and the apparent health, contentment, and energy of the workers, which attracted my attention as soon as I entered the mill, indicate that the efforts of the proprietor have been successful.

COTTON-GOODS TRADE.

EFFECT OF DOMESTIC INDUSTRY'S DEVELOPMENT.

The rapid growth of the cotton industry in Italy is strikingly evidenced by figures showing the imports and exports of cotton manufactures. Formerly one of England's best customers, Italy has in recent years become one of her chief competitors in the world's cotton-goods trade. This has an interest to American manufacturers because Italy is also competing with American cotton goods in some of our principal markets—in the Levant and Red Sea districts and, notably, in Central and South America.

The following table showing the imports of raw cotton and the imports and exports of yarn, thread, etc., and cloth and other manufactures from 1870 to the present time illustrates very clearly the progress of the industry and the growth of the trade. Up to 1900 average yearly figures are given:

Years.	Raw cotton imports.	Yarn, thread, etc.		Other manufactures.	
		Imports.	Exports.	Imports.	Exports.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1871-1875	37,188,533	22,122,650	45,182	25,742,500	432,425
1876-1880	53,062,331	21,029,466	379,308	23,068,827	830,908
1881-1885	101,525,066	20,592,854	220,620	28,278,642	820,247
1886-1890	145,011,298	9,274,212	682,358	22,736,684	1,429,514
1891-1895	194,979,284	3,419,065	1,774,220	11,406,582	6,580,703
1896-1900	262,384,873	1,867,229	11,991,523	4,296,037	20,876,590
1901	287,899,293	1,801,990	21,103,520	3,575,990	32,365,300
1902	311,444,816	1,832,346	19,414,816	4,016,129	30,262,022
1903	324,573,162	1,977,870	20,280,767	4,006,872	38,110,686
1904	324,931,312	2,065,589	20,787,246	5,957,192	54,149,635
1905	345,223,320	1,820,063	22,550,446	6,607,151	54,899,241
1906	403,484,529	1,884,511	22,922,548	7,336,247	61,765,837
1907	480,525,415	4,377,674	18,632,265	9,275,193	88,408,892
1908	455,786,500	2,802,011	15,353,496	9,709,535	51,290,574
1909	420,729,171	2,117,515	20,804,746	9,970,938	69,179,319
1910	384,940,797	2,425,940	27,817,863	11,117,473	79,254,003
1911 (6 months)	249,314,466	1,203,048	17,017,301	6,454,882	47,466,122

The heavy importation of yarn in 1907 and 1908 was due to the fact that high prices attracted foreign yarns to the home market and British India exported large quantities to Italy.

CHANGE IN CHARACTER OF TRADE.

These figures tell the story of how Italy has gradually ceased to purchase its supply of cotton manufactures abroad, and how the home industry has not only taken possession of the domestic market but has become a prominent factor in the foreign trade.

With the exception of recent years, during which there has been a world-wide depression in the cotton industry, the exports of yarn and cloth show a steady and rapid increase. Italy to-day ranks next to the United States as an exporter of cotton goods, and this is an

astonishing fact when we consider that the total number of spindles engaged in the Italian industry is but slightly more than the number in South Carolina, and that these are practically confined to a section much smaller in area than that State. None of the natural advantages enjoyed by the United States are possessed by the Italian manufacturers; their raw material, their fuel, and their machinery are purchased from abroad; but in spite of these handicaps the industry shows a growth unequalled by that of any other nation in the world.

IMPORT TRADE.

The total value of the yarn, thread, etc., imported in 1910 was \$1,336,726 and of cloth, etc., \$8,122,347. The imports of yarn consisted mainly of fine counts or specially colored and ply yarns. The cloth imports are chiefly extra-fine qualities of goods, specialties and novelties, embroideries and embroidered tissues, the demand for which has not been sufficient to make production profitable to local manufacturers. According to some of the leading merchants a considerable part of the demand for foreign goods comes from foreigners residing in Italy and from tourists, many thousands of whom visit Italy every year. There is, however, a growing tendency to engage in the manufacture of the lines mentioned, owing to the fact that the increasing wealth of Italy has created a demand for finer fabrics. In the past the Italian has been inclined to buy a cheaper article, irrespective of quality, and the cotton manufacturers, appreciating this fact, have catered to the requirements and produced goods at the lowest possible cost by the means already referred to—the use of cheaper cottons, the heavy sizing of goods, and the weaving of split goods.

KINDS OF GOODS IMPORTED.

The following table shows in detail the various kinds of goods imported during 1908, 1909, and 1910. The quantities are stated in pounds, and values are also given for 1910. For the determination of customs values in Italy there is a permanent central commission, and the values are those recorded at the frontier, exclusive of all duties:

Articles.	1908	1909	1910	
			Quantity.	Value.
Raw cotton.....	<i>Pounds.</i> 455,786,500	<i>Pounds.</i> 420,729,171	<i>Pounds.</i> 384,940,797	\$61,248,904
Waste.....	(¹)	(¹)	6,058,453	364,271
Wadding.....	74,515	42,549	131,394	17,254
Total.....	455,861,015	420,771,720	390,130,644	61,620,429
Yarn:				
Single—				
Gray.....	980,165	227,294	273,180	94,313
Bleached.....	59,745	118,166	226,904	65,637
Dyed.....	37,699	27,117	34,392	11,220
Twisted—				
Gray.....	406,749	248,459	266,006	140,754
Bleached.....	49,383	50,264	55,201	24,063
Dyed.....	415,346	484,350	539,206	212,856
Chain warps.....	220	220	2,204	579
Vigogna yarn.....	440	220	1,323	382
Sewing thread.....	859,574	894,185	962,828	780,731
Twine and cord.....	21,826	23,599	31,746	8,337
Fish nets.....	30,864	43,661	38,801	27,854
Total.....	2,862,011	2,117,515	2,425,940	1,336,726

Articles.	1908	1909	1910	
			Quantity.	Value.
Fabrics:				
Gray—	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
Plain.....	891,099	944,230	942,466	\$336,145
Figured.....	2,866	661	4,189	1,812
Bleached—				
Plain.....	800,931	826,945	855,826	338,397
Figured.....	85,097	69,224	66,358	33,527
Colored or dyed—				
Plain—				
Not mercerized.....	1,174,390	1,278,888	1,415,573	614,908
Mercerized.....	179,013	210,980	290,346	125,892
Figured.....	396,386	307,100	317,242	158,539
Printed—				
Plain.....	1,181,165	1,192,468	1,174,390	600,537
Figured.....	21,605	19,841	18,078	11,968
Cotton felt, woven, for paper manufacture.....	1,543	18,078	10,362	4,535
Transmission belt, not sewn.....	3,527	14,991	7,496	3,064
Cotton blankets.....	128,528	132,276	136,244	77,528
Cotton tissues for surgical purposes.....	4,629	5,952	5,952	3,648
Handkerchiefs and shawls.....	125,442	115,962	124,560	75,511
Brocades.....	104,057	85,979	137,126	84,032
Embroidery and embroidered fabrics.....	352,295	391,096	421,740	929,980
Muslin and gauze.....	86,961	50,044	90,389	106,874
Fabrics, tarred, oiled, etc.....	31,746	78,484	27,116	9,667
Oilcloth.....	909,397	817,024	1,128,755	365,619
Emery cloth.....	140,653	112,435	135,830	29,722
Velvet.....	609,351	697,756	890,658	820,066
Knit goods:				
Stockings and gloves.....	282,630	348,327	422,181	420,755
Other.....	204,807	160,494	162,258	75,490
Lace.....	325,288	331,664	327,037	831,182
Tulle.....	107,584	172,399	214,287	649,734
Braid and ribbon.....	210,980	241,624	282,188	148,224
Trimmings.....	115,521	127,426	161,377	90,351
Buttons.....		220	661	313
Mixed fabrics:				
Cotton and silk.....	90,388	91,931	128,528	148,825
Cotton and wool.....	513,671	450,179	414,197	398,912
Cotton and metallic threads.....	3,964	9,149	12,612	149,735
Sacks, bed and table linen, towels, etc.....	235,451	223,767	243,829	81,114
Collars, cuffs, and shirts.....	55,776	53,351	54,013	68,199
Corsets, etc.....	31,746	44,753	77,822	47,680
Other made-up goods.....	301,148	345,240	415,787	289,524
Total.....	9,709,535	9,970,988	11,117,473	8,122,847

¹ Included in raw cotton.

SOURCE OF IMPORTS.

Practically all of the cotton goods purchased from abroad are furnished by Germany, England, France, Switzerland, and Austria, in the order named. Germany ranks first in the imports of yarn, embroideries, knit goods, velvet, braids and ribbons, tulle, and similar articles. England leads in the imports of cotton cloth. France furnishes sewing thread, figured goods, embroideries, and lace, and Switzerland's trade is practically along the same lines.

Germany not only holds first place in the total imports of cotton manufactures, a position formerly held by England, but also ranks first as a supplier of Italy's needs in all lines. This position Germany has undoubtedly attained and held through aggressive salesmanship methods. German commercial travelers flood the country, they offer their goods at a lower price than their competitors, they are willing to accept small orders in order to get trade started, and they give liberal terms of credit, which is so essential for the transaction of business with Italians.

The source of the imports of cotton manufactures is shown in the table following, which gives the value of the imports by articles and principal countries in 1910.

Articles.	Austria-Hungary.	France.	Germany.	Great Britain.	Switzerland.	All other countries.
Raw cotton.....		6,188	33,585			61,209,191
Waste.....	2,604	27,607	117,653	77,941	86,279	26,187
Wadding.....	7,585	58	8,222	347	724	313
Total.....	17,189	23,853	159,400	78,288	87,003	61,264,636
Yarn:						
Single—						
Gray.....	358	8,989	12,854	52,547	19,568	
Bleached.....	142	25,089	20,230	535	18,181	450
Dyed.....	208	2,582	5,638	1,721	1,671	
Twisted—						
Gray.....		1,883	25,503	100,139	12,467	763
Bleached.....	93	668	11,789	9,839	1,674	
Dyed.....		894	157,393	4,885	49,308	376
Chain warps.....		521		58		
Vigogna yarn.....			255	137		
Sewing thread.....	5,627	68,090	315,613	323,256	3,821	24,914
Twine and cord.....	58	232	1,563	5,443	174	867
Fish nets.....	1,583	12,819	11,870	1,424	158	
Total.....	7,499	121,767	562,708	499,964	107,419	37,369
Fabrics:						
Gray—						
Plain.....	1,243	9,517	36,513	232,795	42,003	14,674
Figured.....			146	1,666		
Bleached—						
Plain.....	9,967	29,588	113,005	120,514	27,215	17,988
Figured.....	3,168	3,113	12,627	14,241	328	116
Colored or dyed—						
Plain.....						
Not mercerised.....	27,578	48,853	164,760	313,861	27,280	12,576
Mercerised.....	10,422	5,021	41,693	62,597	13,280	2,888
Figured.....	8,970	30,197	47,111	66,553	3,123	376
Printed—						
Plain.....	22,006	17,911	268,381	264,003	12,306	5,330
Figured.....	4,976	651	1,726	4,122		511
Cotton felt, woven, for paper manufacture.....	366	1,834	1,062	1,062		191
Transmission belt, not sewn.....	181		1,462	1,270	181	
Cotton blankets.....		2,509	3,638	66,113	261	4,618
Cotton tissues for surgical purposes.....		135	3,513			
Handkerchiefs and shawls.....	6,379	11,725	6,793	1,680	46,944	
Brocades.....	135	3,648	69,036	1,081	10,132	
Embroidery and embroidered fabrics.....	8,174	61,461	494,977	17,505	287,647	60,216
Muslin and gauze.....	1,631	32,135	25,563	44,284	2,355	908
Fabrics, tarred, oiled, etc.....		68	4,611	4,719	203	66
Oilcloth.....	1,006	7,509	18,709	288,925	3,642	45,774
Emery cloth.....	1,399	2,075	18,335	2,799	1,830	3,184
Velvet.....	26,786	83,526	375,567	258,697	11,098	66,353
Knit goods:						
Stockings and gloves.....	4,039	16,006	381,676	6,022	12,221	102
Other.....	1,370	3,636	22,990	1,243	855	45,326
Lace.....	25,563	209,146	306,216	211,668	69,579	7,719
Tulle.....	1,448	51,338	61,857	28,564	17,553	488,674
Braid and ribbons.....	6,948	29,297	91,898	4,632	12,549	2,209
Trimmings.....	2,096	13,688	46,563	6,624	8,589	2,801
Buttons.....		104	209			
Mixed fabrics:						
Cotton and silk.....	1,783	44,073	95,790	4,331	2,548	
Cotton and wool.....	12,526	88,170	266,861	58,383	1,063	1,916
Cotton and metallic threads.....	1,280	19,802	118,683	1,400	1,532	20
Sacks, bed and table linen, towels, etc.....	5,207	4,634	29,909	44,371	2,127	1,406
Collars, cuffs, and shirts.....	18,644	5,004	34,045	6,215	811	540
Corsets, etc.....	7,836	18,003	17,158	676	270	3,647
Other made-up fabrics.....	24,122	53,779	146,226	22,089	10,654	12,944
Total.....	276,295	878,343	3,334,898	2,175,263	683,658	804,510

Of the total imports of cotton manufactures, which were valued at only \$9,459,073, more than one-third consisted of sewing thread, embroideries, lace, and velvet, the value of these items being \$3,331,959.

IMITATION OF FOREIGN GOODS AND BRANDS.

Italy offers a small field for the sale of foreign cotton goods. Not only does the tariff protect the home industry, but the ability of the local manufacturers to supply the country's demand at a low price,

their intimate knowledge of the trade's needs, and the quickness with which they adopt new patterns and styles from abroad, as they appear on the home market, have enabled them to shut out serious foreign competition. If the people demand foreign goods, the manufacturer puts on foreign brands or labels to suit, and one frequently sees cotton goods in the shop windows marked "English zephyrs," "English flannel," "Victoria lawn, superior quality," "English fine sheeting," etc., all of which are manufactured at home and marked in a foreign language to accommodate the fancy of a class of people who demand the foreign article.

This tendency to imitate foreign brands and trade names is not confined to the home market, and large quantities of goods branded "American sheeting," "Cabot" (or sometimes "Cadot") are manufactured and exported by Italy each year. To such an extent has this been carried that an Italian mill at one time put up sheetings with an American flag stamped on the outside fold. The imitation of American brands has long been a subject of concern to cotton mills in the United States, and while the practice is not so general as formerly, owing partly to the appeal to the manufacturers made by the Italian Minister of Commerce six or eight years ago, the Italian manufacturers are taking advantage of the preference for American cottons wherever it is found to exist.

The use of the word "Cabot" is fairly illustrative of the methods followed not only by Italian manufacturers, but by other countries as well. This is the brand of a well-known 3-yard sheeting made in the United States, the popularity of which throughout the Levant has led to the production of numerous imitations of lower quality in England, Italy, and Spain. In fact, this practice has been carried so far that to-day the word "cabot" is used throughout the Levant as a generic term for sheetings, without regard to quality or weight, and the value of the brand as a trade name has been all but lost.

The rule among Italian manufacturers has always been "to find out what the people want and give it to them," and undoubtedly this policy has been the chief factor in the expansion of Italy's export trade in cotton goods.

IMPORTS FROM THE UNITED STATES.

According to the Italian statistics, the imports of manufactured cotton from the United States in 1910 amounted to \$143,250, divided as follows:

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
	<i>Pounds.</i>			<i>Pounds.</i>	
Sewing thread.....	220	\$174	Oilcloth.....	135,362	\$43,846
Fabrics:			Emery cloth.....	6,173	1,351
Gray, plain.....	6,173	2,061	Velvet.....	441	270
Bleached, plain.....	43,431	16,175	Knit goods.....	\$2,152	45,326
Colored or dyed—			Lace.....	148	388
Plain—			Braid and ribbon.....	2,206	1,158
Not mercerized....	22,266	9,475	Trimming.....	2,866	1,401
Mercerized.....	5,732	2,557	Fabrics of cotton with metal-		
Figured.....	1,323		lic threads.....	4	19
Printed—			Sacks, bed and table linen,		
Plain.....	7,496	3,978	towels, etc.....	441	147
Figured.....	220	131	Corsets, etc.....	2,425	1,486
Cotton blankets.....	8,377	4,767	Other made-up goods.....	9,921	6,514
Embroidery and embroidered			Total.....	348,438	143,250
fabrics.....	882	1,969			
Fabrics, tarred, oiled, etc.....	220	67			

EXPORT TRADE.

A study of Italy's export trade in cotton goods and the means by which it has been developed should be of interest to American cotton manufacturers, because Italian goods, as already stated, come into competition with those from the United States, particularly in South America, the Red Sea ports, and Turkey. In the two localities last named the cheaper Italian sheeting in imitation of the American brands has made serious inroads on American sales, and at some points has all but driven the American product off the market.

KIND OF GOODS EXPORTED.

The kind of goods which Italy is exporting and the lines along which increased sales have been made in recent years are shown in the following table of the exports in 1908, 1909, and 1910:

Articles.	1908	1909	1910	
			Quantity.	Value.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
Raw cotton.....	230,821	369,050	214,728	\$31,957
Waste.....	14,849,304	19,007,620	16,902,227	1,183,754
Wadding.....	419,094	669,096	826,679	36,886
Total.....	15,409,219	20,045,766	17,643,634	1,252,597
Yarn:				
Single—				
Gray.....	9,459,087	12,534,017	19,346,688	2,560,541
Bleached.....	1,255,520	1,572,541	1,945,780	274,732
Dyed.....	1,277,786	1,328,061	1,671,538	371,166
Twisted—				
Gray.....	1,293,087	2,727,310	2,173,956	405,022
Bleached.....	564,508	761,245	667,332	142,695
Dyed.....	1,182,547	1,602,524	1,630,302	413,182
Sewing thread.....	208,571	246,253	374,120	163,760
Twine and cord.....	4,136	14,550	1,543	405
Fish nets.....	10,141	16,314	6,614	4,746
Total.....	15,353,496	20,804,746	27,817,863	5,496,310
Fabrics:				
Gray—				
Plain.....	3,495,920	10,406,118	13,401,964	2,234,441
Figured.....	4,409	1,543	2,425	949
Bleached—				
Plain.....	819,670	1,810,428	2,464,082	665,562
Figured.....	66,579	129,630	267,012	68,428
Colored or dyed—				
Plain—				
Not mercerized.....	34,501,329	40,415,609	41,686,087	12,947,326
Mercerized.....	1,174,380	1,327,169	2,267,520	514,267
Figured.....	511,247	1,343,624	2,083,743	767,532
Printed—				
Plain.....	7,558,691	10,089,731	12,737,297	5,480,787
Figured.....	20,723	10,141	6,614	3,402
Cotton felt, woven, for paper manufacture.....		882		
Transmission belt, not sewn.....	15,208	52,249	209,437	110,010
Cotton tissues for surgical purposes.....		2,866	2,425	1,380
Shawls and handkerchiefs.....		1,764	17,416	10,224
Brocades.....			661	382
Embroidery and embroidered fabrics.....	128,027	115,080	126,103	260,897
Muslin and gauze.....	6,834	15,873	2,645	2,306
Fabrics, tarred, oiled, etc.....	3,066	2,866	3,527	1,061
Oilecloth.....	17,416	21,825	19,180	5,877
Emery cloth.....		220	220	48
Velvet.....	882	882	28,573	18,460
Knit goods:				
Stockings and gloves.....	91,270	125,142	67,240	34,161
Other.....	1,368,780	1,589,958	1,870,162	618,303

Articles.	1908	1909	1910	
			Quantity.	Value.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
Lace.....	32,125	19,451	30,924	\$67,680
Tulle.....	11,463	17,416	21,164	36,554
Braid and ribbon.....	331,351	300,928	397,930	206,019
Trimming.....	457,454	529,765	698,858	379,322
Buttons.....		220	220	104
Mixed fabrics:				
Cotton and silk.....	127,205	98,766	83,113	96,044
Cotton and wool.....	97,002	248,899	459,218	442,221
Cotton and metallic threads.....	683	476	2,105	17,744
Sacks, bed and table linen, towels, etc.....	39,462	31,967	42,549	14,154
Collars, cuffs, and shirts.....	85,759	91,270	84,657	103,757
Corsets, etc.....	25,353	44,974	48,080	29,452
Other made-up goods.....	296,196	281,307	254,852	167,331
Total.....	51,290,574	69,179,319	79,254,003	26,619,693

DESTINATION OF CLOTH EXPORTS.

Gray, bleached, colored, and printed cloth are the principal fabrics exported, as shown in the foregoing table. The quantity of these articles exported to various countries during 1908, 1909, and 1910 is given in the table following:

Countries.	1908	1909	1910
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Argentina.....	18,335,217	22,899,039	17,946,105
Turkey:			
Asiatic.....	779,105	6,336,902	12,402,639
European.....	9,337,904	12,956,655	10,107,209
Egypt.....	5,518,334	4,535,303	4,478,424
Eritrea.....	2,021,618	4,370,620	3,802,714
British India.....	1,794,325	1,813,504	3,074,315
Roumania.....	384,041	1,645,954	2,371,712
Aden.....	150,796	647,491	2,357,599
Uruguay.....	180,936	442,684	1,883,390
Dutch East Indies.....	1,658,961	1,466,941	1,544,984
Greece.....	174,163	650,798	1,481,429
Chile.....	817,245	906,531	1,390,000
Brazil.....	296,078	295,416	1,143,526
French Africa.....	12,566	61,729	720,684
Peru.....	295,637	144,181	646,609
Switzerland.....	762,130	570,771	632,720
Bulgaria.....	101,412	488,319	608,911
Servia.....	3,527	230,160	596,344
Tunis.....	284,173	384,023	558,646
Colombia.....		10,141	557,984
Austria-Hungary.....	2,463,420	1,104,284	456,352
Japan.....	60,626	3,686	436,511
China.....	452,604	504,192	384,041
Central America.....	474,430	612,217	379,853
Venezuela.....	3,527	37,037	356,925
Candia.....	20,944	77,161	349,208
France.....	374,562	333,115	339,950
Straits Settlements.....	33,510	109,569	332,895
Mexico.....	465,391	663,364	289,244
Germany.....	177,691	145,504	228,837
Other countries.....	741,188	1,142,204	2,465,625
Total.....	48,155,960	65,579,795	74,805,385

TREND OF EXPORT TRADE.

The general trend of Italy's export trade in cotton goods is indicated in the following table, which gives the value of the exports, by countries, in 1895, 1900, 1904, and 1909:

Countries.	1895	1900	1904	1909
Argentina.....	\$1,573,000	\$4,203,000	\$7,023,000	\$8,183,000
Turkey:				
Asiatic.....	48,000	530,000	1,747,000	2,712,000
European.....	560,000	1,658,000	4,049,000	5,663,000
Egypt.....	132,000	848,000	1,562,000	1,893,000
Eritrea.....	(1)	(1)	(1)	1,103,000
Roumania.....	73,000	187,000	830,000	1,063,000
British India.....	16,000	829,000	898,000	693,000
Austria-Hungary.....	48,000	651,000	1,318,000	618,000
Dutch East Indies.....	(1)	(1)	(1)	467,000
Switzerland.....	141,000	267,000	454,000	435,000
Chile.....	36,000	468,000	481,000	418,000
Bulgaria.....	(1)	(1)	(1)	245,000
Greece.....	13,000	84,000	270,000	227,000
United States.....	140,000	125,000	277,000	221,000
Mexico.....	1,000	65,000	112,000	221,000
Central America.....	36,000	282,000	214,000	218,000
France.....	135,000	199,000	224,000	214,000
Brazil.....	831,000	752,000	683,000	179,000
Tunis.....	55,000	64,000	161,000	189,000
Uruguay.....	230,000	121,000	133,000	198,000
China.....	(1)	(1)	(1)	181,000
Aden.....	(1)	(1)	(1)	151,000
England.....	(1)	(1)	(1)	119,000
Germany.....	181,000	340,000	273,000	102,000
Malta.....	(1)	(1)	(1)	95,000
Servia.....	(1)	(1)	(1)	90,000
Cyprus.....	(1)	(1)	(1)	77,000
Peru.....	56,000	214,000	335,000	58,000
Australia.....	1,000	116,000	205,000	56,000
All other countries.....	155,000	\$76,909	1,643,000	310,000
Total.....	4,711,000	12,369,909	22,712,000	26,439,000

¹Not separately stated.

MARKETS FOR VARIOUS CLASSES OF GOODS.

In value colored goods form the largest item of export, followed by printed goods, single gray yarn, plain gray cloth, figured and mercerized goods, and bleached goods, in the order named. The cotton yarns exported consist mainly of low and medium counts, Nos. 10 to 30, and Turkey, the Balkans, Austria, and Argentina are the chief customers. The exports of single gray yarn to Asiatic Turkey amounted to 279,763 pounds in 1908, and to 5,632,092 pounds in 1910. while the shipments to Roumania increased in the same period from 632,720 to 3,038,599 pounds. The bulk of the sewing thread exported goes to European Turkey. A large part of the exports of both yarn and cloth sold in Austria is later transshipped, mainly to the Balkans.

The Italian colony of Eritrea, in Africa, ranks first in the purchase of gray and bleached goods, followed by Turkey, the Balkans, and Aden. Colored goods are shipped to practically all the countries listed in the foregoing table, but most of these fabrics go to Argentina, Turkey, Egypt, British India, the Dutch East Indies, Roumania, Greece, Tunis, and Central America. Printed goods are not shipped in large quantities to South America, the Levant and northern Africa being the principal markets.

The gray and bleached goods include drills and sheetings, T cloths, madapollam, mexicans, piqués, and white flannelettes. The dyed and

printed goods comprise a very wide variety of fabrics, but the principal exports are cotton trouserings, made in dark colors, and in imitation of wool through the use of burred and other fancy yarns; reps and poplins, large quantities of which go to the South American markets; flannelets and barchent, sold principally in Turkey; cretonnes, sateens, oxfords, gros de Tours or bed covers, zephyrs and vichys, and printed handkerchiefs and head shawls or covers.

TRADE WITH TURKEY AND OTHER NEAR-BY COUNTRIES.

Italy has secured a large share of trade in the markets near home, particularly in Turkey, where the cheap and heavily sized Italian sheetings have practically driven the American goods off the market, and are being sold in sharp competition with those from England. A specialty of the Italian cotton industry is printed flannelet, most of which is woven in double widths and split. One variety of these goods is barchent, which is napped on one side only and printed on the other, and which is used in Turkey during winter for outer garments. The split goods are made in 55 to 60 centimeter (21.65 to 23.62 inch) widths (after splitting), and are put up in 40 to 50 meter lengths to the piece. The goods are also woven in single widths of about 70 centimeters (27.56 inches).

Most of the barchent exported is printed in gay and bright colors; only a small portion is printed in solid colors, as fantastic designs are preferred. Prices are quoted, for Turkey, *c. i. f.* Constantinople or Smyrna, and at present are 40 to 60 centesimi per meter (7.05 to 10.58 cents per yard), according to the width and weight.

The sheetings shipped to Turkey and the Levant are chiefly made in imitation of the American Cabot brand, in various widths and in pieces of 30 to 36 meters. The 36-inch width is quoted at about 0.45 lire per meter (7.93 cents per yard). The trade in Turkey has been secured by catering to the demands of the customer and by a close study of the colors and designs most likely to attract the natives and become popular. An unlimited number of patterns is prepared each season, attractive sample books are made up, and a wide range of patterns is packed in each bale or case, as desired.

Liberal discounts and terms are offered; in the case of colored goods 5 per cent four months, and gray goods $2\frac{1}{2}$ per cent two or three months. Accustomed to giving long terms at home, the Italians do not find it difficult to offer the same terms abroad, and this has been an important factor in the development of their export trade. At Beirut, Smyrna, and Constantinople, in Syria, Greece, and the Balkans, many Italian manufacturers have established branch houses or agencies, which often enables them to quote prices delivered to the merchants in the interior and keeps them in touch with the markets in those districts. These agents are close students of the demands of the trade, they are quick to discover new styles and patterns, and they frequently send home samples of the goods desired.

In packing goods for export the manufacturers take great pains to put up an attractive package. Each piece of goods is neatly labeled and wrapped in a good quality of glazed paper, with a sample of the goods on the outside and details as to quality, width, and length of

the piece. When the customer desires the goods shipped in cases the latter are lined with metal to offer ample protection against dampness or damage from any cause.

In Greece, Italy ranks second only to England in the imports of cotton goods; in the Balkans her trade is increasing every year; in Egypt, Morocco, and Tunis a good trade has been built up in colored and printed goods through the readiness of the Italian manufacturers to adapt themselves to the constantly changing styles in those countries. The exports to China, while small, have shown a substantial increase in recent years, while the exports to India, owing to the competition of the Indian mills, have fallen off.

SALES TO THE UNITED STATES.

Italy also ships cotton goods to the United States (value \$157,367 in 1910), the chief item of export being embroideries, \$48,829; colored and dyed goods, \$33,398; cotton blankets, \$10,190; and cotton goods mixed with silk, \$29,800. Most of these goods are sold to Italian houses in the United States to supply the demands of the Italians in the country, and the largest single item of colored goods consists of cotton trousering, slightly napped on one side, which is a specialty of the Italian cotton industry.

A considerable quantity of cotton table covers is shipped to the United States, the production of which has already been referred to. They are usually 60 by 18 inches, are woven on a Jacquard hand or mechanical loom, and are richly ornamented with scenes of Italian life or cities. Some of them are sold as low as \$1.75 per dozen, while others are quoted as high as \$7 per dozen. Gros de tours, or bed covers, form another item of export. They are usually made up in blue and white or pink and white designs and they form one of the chief products of hand-loom weaving. The total exports of cotton goods to the United States are decreasing rather than increasing, however, the total amount being \$157,367 in 1910, as compared with about \$221,000 in 1909. A considerable amount of waste is shipped to the United States (\$358,918 in 1910). A Philadelphia waste company has a branch near Milan, and practically all the waste exported to the United States is handled by this firm.

Formerly Italy sold a quantity of goods to the Philippines, but since the new tariff went into effect in the islands the exports have dwindled to almost nothing. The value of all the cotton manufactures shipped to the Philippines in 1909 was a little less than \$8,000 and consisted of low counts of gray cotton yarn, betilles or gauze, and cheap colored goods, such as plaids and calicos.

TRADE WITH SOUTH AMERICA.

Italy has found her best market for cotton goods in South America and the shipments of cotton manufactures to countries in Central and South America comprise more than one-third of the total exports of cotton goods. Argentina ranks first as a buyer of Italian cotton goods. Moreover, cotton goods form the largest single item in Italy's total trade with Argentina, and of the total imports of cotton goods by the latter country Italy furnishes one-fourth. Italy also ships goods to Chile, Brazil, Uruguay, and Peru.

The following table, showing the exports of cotton manufactures to Argentina in 1905 and 1909, will give an idea of the character and growth of this trade:

Articles.	1905	1909	Articles.	1905	1909
Yarn and sewing thread.....	\$651,000	\$613,000	Trimming.....	\$110,000	\$126,000
Gray goods.....	54,000	107,000	Knit goods.....	133,000	80,000
Bleached goods.....	83,000	221,000	Mixed goods.....	60,000	52,000
Colored goods.....	4,315,000	6,640,000	All other articles.....	187,000	81,000
Printed goods.....	100,000	203,000			
Cotton blankets.....	1,000	10,000	Total.....	6,194,000	8,183,000
Embroideries.....	800	50,000			

Colored goods form, by far, the largest proportion of the total amount, and these goods consist of trouserings and ladies' dress goods made in imitation of wool, which have already been mentioned; napped goods, particularly barchent and the so-called tartans, or napped plaids; reps dyed in a variety of colors and many with the filling of Indian cotton; oxfords, gingham, carolines, florides, cretonnes, and fancy vestings. Gross de Tours, tablecloths, handkerchiefs, lace, tape, braids, and towels are also exported. In the gray and bleached goods the principal fabrics are plain three and four yard sheetings, T cloths, percales, piqués, madapollams, and muslins. The yarns exported consist chiefly of single gray and colored yarns in numbers up to 20.

EFFECT OF EMIGRATION.

The important place which Italy has attained in the South American trade illustrates the methods by which that country has exploited its goods in foreign markets. Italy's best industrial agent has been its overflowing population, and this is particularly true in the case of the South American trade. For many years Italians have been emigrating to Argentina and other countries in South America, attracted thither by the resources of the country and the similarity of the native population to the Italian people as regards temperament, race, and language.

This tide of emigration began about 1876, and has been steadily increasing in the past 20 years. An average of more than 100,000 Italians emigrated to South America in each of the years from 1905 to 1910, the majority of whom went to Argentina; to-day the Italian population of that country numbers more than 1,000,000, or about one-fifth of the total population.

Recently, however, a check has been put on the movement by the strict regulations imposed by the Argentine Government. It is largely upon the demand created by these emigrants that Italy has established in South America the immense volume of business it now enjoys.

EXPORT ASSOCIATIONS—AGENCY SYSTEM.

The pioneer who opened the way for this trade was Enrico Dell'Acqua, a great merchant and political economist of Milan. In 1877 he went into Argentina, Paraguay, Peru, and Brazil and made a close study of conditions there. His reports first brought to the

attention of the Italian manufacturers the value and importance of those countries as a market for their products. In 1887 the Society for Exportation and for the Italian-American Industry was founded in Milan for the purpose of encouraging the exportation of cotton goods to South America. To-day this company has a capital of 12,000,000 lire (\$2,316,000), and is not only engaged in handling the products of a number of Italian mills, including one of its own, but is also operating cotton mills in Brazil and Argentina. The profits of the firm have averaged over 15 per cent, and its shares sell well above par.

The United Italian Industries for Exportation is another important concern of a similar nature, and its activities extend not only to South America but to Central America, Australia, India, the Dutch East Indies, and South Africa as well. Other export companies are the Enrico Dell'Acqua & Co., with a capital of 8,000,000 lire (\$1,544,000); the Società Commissionaria d'Esportazione, with a capital of 3,000,000 lire (\$579,000); and the Compagnia Commerciale Italo-Americano, with a capital of 1,500,000 lire (\$289,500).

The development of the South American trade has also been greatly assisted through the efforts of the Associazione Cotoniera Italiana, or Cotton Manufacturers' Association of Italy. This association includes more than 80 per cent of the cotton manufacturers in Italy, and it is very active in bringing to the attention of its members opportunities for increasing the export trade. Information relative to foreign markets and trade conditions is gathered from its correspondents in all parts of the world, and this information is either published in the monthly bulletin or transmitted confidentially to the members of the association.

In the campaign for trade in South America personal representation rather than long-distance correspondence has been the policy of the cotton manufacturers. After realizing that a market existed, banking arrangements were made to meet the local demand for credit, and transportation lines were studied with care. After a preliminary investigation of the field the manufacturers set themselves to the task of placing before the natives the exact goods which they demanded and on terms that were most acceptable to them. It is usual for the more important mills and export companies to have not only resident agents but also traveling salesmen. These men are selected with great care, are peculiarly fitted for the work in hand, and are able to speak fluently the language of the country or countries to which they are sent.

EXAMPLE OF ITALIAN EXPORT METHODS.

The methods employed by one firm in Milan to secure a foothold in South America are sufficiently typical to be instructive. When this company decided to enter the field about 15 years ago it considered the qualifications of all the traveling men known to it, and selected a Spanish-speaking Italian well acquainted with the export field. This man was offered an attractive salary and brought into the office at Milan in order that he might gain a clear idea of the firm's business. He also studied the methods of manufacture, and when his work of preparation was complete he went out to the River Plate country and to Rio de Janeiro and Pernambuco fully authorized to

inaugurate a campaign for trade. He also took with him a full line of samples showing everything produced by the mill.

In South America this agent got in immediate touch with the Italian chambers of commerce, many of which have been established in the large cities, and with the banks and with the trade. He studied the railroad lines and all other means of transportation. Meanwhile, he had been looking around for men, and he finally selected five resident agents. This took several months' time, and in the interval not a single order for goods had been sent in, but no pressure was brought to bear on him from the home office to make him hasten the work undertaken. The resident agents, whom he had selected with great care, were employed on a strict commission basis under a five-year contract, the samples were distributed among them, and the traveling salesman returned to Milan. Soon the orders from the resident agents began to come in, and the shipment of goods was begun.

At first, of course, there were complaints. The agents had been carefully instructed to get in close touch with the merchants and to report fully to the manufacturer. As a result some rather sharp criticisms were sent in; there had been errors in following shipping instructions; the goods had not been packed as desired; second quality of cloth had been sent out, etc. The mill, however, accepted the criticisms in the spirit in which they were offered and sought to correct its mistakes. The agents began to send in samples of goods that were in demand, which in some cases were quite different from those the mill had been manufacturing. But the agents had been told to "find out what they want and tell us how to give it to them," so it was now "up to the mill," and the mill proved its good faith by getting out a complete line of new samples and sending them out by the next week's steamer to South America. Some of these second samples came back, but only a few of them, and soon the orders began to increase in number and the resident agents' commissions rose correspondingly.

At least twice a year the traveling salesman takes a fast and comfortable liner from Genoa to Rio de Janeiro or Buenos Aires, looks over the field carefully, offers any suggestions which may seem fit, and returns to Milan.

This brief account of the practical methods employed by one firm in Italy to secure a share of the South American trade should commend itself to American manufacturers because it illustrates the satisfactory results that follow a sincere and earnest effort to sell goods abroad. It is through such methods that Italy has succeeded to a remarkable degree in entering fields already seemingly occupied by competitors, and these methods are responsible for a large share of the increase in Italy's general foreign trade.

CREDIT SYSTEM.

There is no such thing in the Italian system of marketing goods as cash payments, or anything of that sort. Through the Italian banks and their connections the cotton manufacturers are able to offer attractive terms of credit. When a shipment is made from Milan the documents are sent to the bank or its correspondent abroad accompanied by a draft payable in 60 or 90 days or sometimes longer.

The bank holds the draft until a short time before its maturity, when it notifies the customer in the foreign country to call and settle it.

Little or no difficulty is encountered in regard to payments. The resident agent, in the first place, knows his trade and is well informed about his customer, or he has secured his credit rating through his bank. As the agent is personally interested in making a good sale and, having his own commission in mind, does not sell to any customer until satisfied as to the latter's ability to pay, he thus acts as a check on bad accounts. If the customer is unable to pay and offers a valid excuse, time is granted; otherwise the usual process for collection is begun. But with the firm cited above the losses from collections have been insignificant, and so far as its experience goes Latin American debtors are prompt in meeting their obligations.

TRANSPORTATION FACILITIES.

Having carefully studied the market for cotton goods in South America, having established selling methods to keep them in close touch with the trade, and having arranged banking facilities through which the trade could be conducted, the Italian manufacturers next sought the establishment of a steamship service with regular and frequent sailings, in order that their products might be carried to their customers swiftly, safely, and without delay at port of shipment. They desired that the trade should not only be controlled by Italian hands but should be carried in Italian bottoms. Too much emphasis can not be put on this crowning event in the campaign for foreign trade.

The Italian merchant marine, which in 1861 had a total tonnage of only 10,228, to-day has more than 1,000,000, and new ships are being built every year to keep pace with the increasing trade.

A large proportion of the steamers is engaged in the service to South America, 12 lines having regular sailings to ports in that country. The chief lines are the Lloyd Sabaudo, La Veloce, Lloyd Italiano, Italia, Transporti Marittimi, Adria Line, Navigazione Generale Italiana, Italo Spagnola, Rhederei Vereinigung, Ligure Brasiliana.

In the month of September, 1911, there were 23 sailings from Genoa to various ports in South America, and more than half of these ships made the voyage to Buenos Aires in 15 to 17 days. This means that Argentina is only a few days farther from Genoa than is New York. Most of the ships are not only large and commodious (those built recently being from 8,000 to 10,000 tons) but comfortable, speedy, and provided with every convenience, including wireless telegraphy. Some of the lines make connections along the east coast of Central America and at Montevideo, Valparaiso, Callao, Guayaquil, and intermediate ports with the Pacific Mail Steamship Co. and the Pacific Steam Navigation Co. In short, the influence of Italian transportation extends down the Atlantic, up the Pacific to Panama, and from Panama on to San Francisco.

The service which these lines maintain has brought Italy and South America into closer relations, commercial and otherwise. In the elegantly appointed ships the South American can travel pleasantly and quickly to Italy, and the Italian manufacturer, exporter, or salesman can go out in the same manner.

GOVERNMENT SUBSIDIES.

The liberal Government subsidies which have developed the Italian merchant marine apply not only to the South American lines but also to those running to New York, New Orleans, and Galveston, to Egypt, Turkey, and ports on the Black Sea, and to India and Indo-China. The subsidy paid is at the rate of 15.44 cents per gross ton per 1,000 miles traveled during the first three years of the ship's life, with successive reductions every three years of 1.93 cents per ton for steamers and 2.89 for sailing vessels, until the rate has reached 3.86 cents, where it remains. This rate applies to vessels sailing beyond Gibraltar and the Suez Canal, while the rate for voyages between Italy and ports in Mediterranean waters (including the Adriatic, Marmosa, Azof, and Black Seas and the Danube) is two-thirds of the rate quoted.

In the month of September there were 12 sailings from Genoa to India, China, Japan, and other Far Eastern ports, the same number to points in the United States, and 7 sailings to Red Sea ports, Africa, and Australia.

FREIGHT RATES.

The freight rates on cotton goods from Genoa, which is the point from which most of them are shipped, to the various ports of the world to which Italy is exporting cotton manufactures are as follows (cubic meter=35.3 cubic feet; metric ton=2,204.6 pounds):

Genoa to—	Rate.	Equivalent.
New York.....	25 lire per cubic meter.....	\$5.47 per 40 cubic feet.
Habana.....	40 lire per 40 cubic feet.....	\$7.72 per 40 cubic feet.
San Juan, Porto Rico.....	65 lire per 40 cubic feet.....	\$12.46 per 40 cubic feet.
La Guaira.....	55 lire per 40 cubic feet.....	\$10.62 per 40 cubic feet.
Vera Cruz.....	40 lire per 40 cubic feet.....	\$7.72 per 40 cubic feet.
Rio de Janeiro.....	37.50 lire per cubic meter plus 15 per cent for loading and unloading.	\$9.42 per 40 cubic feet.
Buenos Aires.....	37.50 to 40 lire ¹ per cubic meter plus 15 per cent.	\$9.42 to \$10.05 per 40 cubic feet.
Callao.....	65 lire per 40 cubic feet plus 5 per cent.....	\$13.17 per 40 cubic feet.
Valparaiso.....	60 lire per 40 cubic feet plus 5 per cent.....	\$12.16 per 40 cubic feet.
Smyrna.....	30 lire per metric ton.....	\$5.79 per metric ton.
Constantinople.....	do.....	Do.
Saloniki.....	do.....	Do.
Bucharest.....	45 lire per metric ton plus 10 per cent.....	\$9.55 per metric ton.
Aden.....	40 lire per cubic meter.....	\$8.75 per 40 cubic feet.
Alexandria, Egypt.....	30 lire per metric ton plus 10 per cent.....	\$6.37 per metric ton.
Shanghai.....	57.50 lire per cubic meter.....	\$12.57 per 40 cubic feet.
Manila.....	55.50 lire per cubic meter.....	\$12.35 per 40 cubic feet.

¹ Rate determined by speed of ship.

The freight rate on cotton goods from various cotton-mill towns in Italy to Genoa is as follows:

From—	Rate per metric ton.	
	Lire.	American currency.
Milan.....	17.14	\$3.31
Turin.....	17.88	3.45
Busto Arsizio.....	19.94	3.85
Gallarate.....	20.50	3.96
Bergamo.....	21.26	4.10
Udine.....	41.83	8.07
Perdonone.....	38.96	7.50

CAUSES OF EXPORT TRADE GROWTH.

The remarkable growth of Italy's trade in cotton goods is due not alone to economies in manufacture made possible by the use of Indian and other inferior cottons, the low cost of labor, the heavy sizing of goods, and the custom of weaving split goods. Note has been made of the emphasis placed on the personal equation in South America and how trade has followed in the wake of emigration. The development has been aided by the thorough methods of marketing, and by the establishment of banking and transportation facilities that enable the manufacturers to extend credit and to land their goods quickly and safely at the customer's door. These advantages, added to the fact that the Italians study closely the demands of the trade and do not hesitate to cater to them in every possible way, have secured to Italy its present important place in the world's cotton-goods trade.

LIST OF SAMPLES.

Accompanying the foregoing report were samples of cotton goods manufactured in Italy, which have been filed in the Bureau of Manufactures and which will be loaned, upon application, to interested persons and firms. Following is a brief description of these sample:

Sample 1.—Cotton trousering; 61 to 62 centimeters (23.6 to 24 inches) wide; price, 0.85 to 0.87 lira per meter (15 to 15.34 cents per yard).

Sample 2.—Cotton trousering; 128 to 130 centimeters (50.39 to 51.18 inches) wide; price, 1.50 to 1.55 lire per meter (26.42 to 27.30 cents per yard).

Sample 3.—Printed flannel; 115 centimeters (45.28 inches) wide; price, 1.15 to 1.20 lire per meter (20.24 to 21.13 cents per yard).

Sample 4.—Jacquard flannel, woven from dyed yarns; 68 to 70 centimeters (26.77 to 27.56 inches) wide; price, 0.65 to 0.67 lira per meter (11.46 to 11.81 cents per yard).

Sample 5.—Flannel, solid color; 68 to 70 centimeters (26.77 to 27.56 inches) wide; price, 0.55 to 0.57 lira per meter (9.70 to 10.05 cents per yard).

Sample 6.—Colored madapolam; 78 to 80 centimeters (30.71 to 31.5 inches) wide; price, 0.65 to 0.68 lira per meter (11.46 to 11.99 cents per yard).

Sample 7.—Fancy shirting or madras; 65 to 67 centimeters (25.59 to 26.38 inches) wide; price, 0.54 to 0.56 lira per meter (9.53 to 9.88 cents per yard).

Sample 8.—Fine shirting; 78 to 80 centimeters (30.71 to 31.5 inches wide); price, 0.60 to 0.72 lira per meter (12.17 to 12.69 cents per yard).

Sample 9.—Oxford; 68 to 70 centimeters (26.77 to 27.56 inches) wide; price, 0.52 to 0.55 lira per meter (9.17 to 9.7 cents per yard).

Sample 10.—Jacquard fantasia (dress goods); 73 to 75 centimeters (28.74 to 29.53 inches) wide; price, 1 to 1.05 lire per meter (17.6 to 18.43 cents per yard).

Sample 11.—Fantasia novita (dress goods); 73 to 75 centimeters (28.74 to 29.53 inches) wide; price, 0.72 to 0.75 lira per meter (12.69 to 13.22 cents per yard).

Sample 12.—Fancy shirting, 73 to 75 centimeters (28.74 to 29.53 inches) wide; price, 0.86 to 0.88 lira per meter (15.17 to 15.52 cents per yard).

Sample 13.—Fancy shirting; 73 to 75 centimeters (28.74 to 29.53 inches) wide; price, 1 to 1.05 lire per meter (17.6 to 18.43 cents per yard).

Sample 14.—Fancy vesting; 78 to 75 centimeters (28.74 to 29.53 inches) wide; price, 0.95 to 1 lira per meter (16.65 to 17.6 cents per yard).

Sample 15.—Fancy vesting; 73 to 75 centimeters (28.74 to 29.53 inches) wide; price, 0.88 to 0.90 lira per meter (15.52 to 15.87 cents per yard).

Sample 16.—Printed summer cashmere; 64 to 65 centimeters (25.2 to 25.59 inches) wide; price, 0.35 to 0.38 lira per meter (6.17 to 6.35 cents per yard).

Sample 17.—Flannel shirting, printed; 68 to 70 centimeters (26.77 to 27.56 inches) wide; price, 0.53 to 0.54 lira per meter (9.35 to 9.53 cents per yard).

Sample 18.—Plain zephyr (gingham); 73 to 75 centimeters (28.74 to 29.53 inches) wide; price, 0.48 to 0.50 lira per meter (8.46 to 8.82 cents per yard).

Sample 19.—Fancy zephyr (gingham); 73 to 75 centimeters (28.74 to 29.53 inches) wide; price, 0.51 to 0.53 lira per meter (9 to 9.35 cents per yard).

Samples 20-26.—Barchent; sold largely in Turkey and the Balkan States; retail price in Milan, 2 lire per meter (35.3 cents per yard).

Samples 27-30.—Cotton flannel; exported to the Balkan States and South America; retail price, 1.50 lire per meter (26.42 cents per yard).

Sample 31.—Heavily sized cotton sheeting; retail price, 0.60 lira per meter (10.53 cents per yard).

Tapestry squares, sold in the United States.

Bobbins; raw cotton from Eritrea; cotton yarn used in manufacture of imitation woolen goods.

**DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF MANUFACTURES**

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 49

**SHOE AND LEATHER TRADE IN
THE UNITED KINGDOM**

By

ARTHUR B. BUTMAN

Commercial Agent of the Department of Commerce and Labor

**TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD**



**WASHINGTON
GOVERNMENT PRINTING OFFICE
1912**

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LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, March 15, 1912.

SIR: I have the honor to submit herewith a report by Commercial Agent Arthur B. Butman on the shoe and leather trade of the United Kingdom. Special attention has been given to the manufacture of boots and shoes, for in this branch of the industry American manufacturers and exporters meet with considerable competition from British concerns, not only in the United Kingdom but also in other foreign countries. The various factors influencing the British import trade in leather and boots and shoes are treated in sufficient detail to give the American exporter a comprehensive idea of the British market, its present requirements, and its possible development.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

TO HON. CHARLES NAGEL,
Secretary of Commerce and Labor.

LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE AND LABOR,
Washington, May 25, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1912, approved March 4, 1911, a report by Commercial Agent Arthur B. Butman, of this department, containing the result of his investigations of the shoe and leather trade in the United Kingdom.

Respectfully,

BENJ. S. CABLE,
Acting Secretary.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

SHOE AND LEATHER TRADE IN THE UNITED KINGDOM.

INTRODUCTION.

The United States dominates the British import trade in boots and shoes, furnishing in 1910 over half of that country's total purchases. Moreover, according to British statistics, the United Kingdom takes about 80 per cent of the total exports of sole leather from the United States and between 50 and 60 per cent of the upper leather.

The importance of the British market to the American manufacturer is therefore evident, but the fact should not be lost sight of that in foreign markets the United Kingdom has been a successful competitor in the boot and shoe trade. In 1910 exports of British-made boots and shoes were valued at \$14,729,963, of which \$5,222,752 went to foreign countries and \$9,507,211 to British possessions. During the same period exports from the United States amounted to \$13,216,237, showing that the two countries are close competitors. British imports average less than one-third the value of the exports, while in 1910 they were less than one-fourth.

Analysis of the statistics reveals the fact that the value per pair of the shoes exported from the United States is higher than that of the British exports. However, during the last five or six years the British manufacturer has greatly improved the style and finish of his output, and this fact has tended to curb imports and to give him still greater control of the home market. Hence the American manufacturer must be prepared to meet keener competition not only in the British market but also in those in which the British manufacturer is seeking trade.

Continuance of the American trade in leather depends largely upon maintenance of quality and success in meeting the requirements of the British market. The tanners of the United Kingdom are improving the quality of their products in various lines, so that the American exporter may expect keen competition from the home producers as well as from other foreign tanners, among whom the Germans seem most active.

An effort has been made in the pages following to present to the American manufacturer and exporter the facts that will enable him to conduct an intelligent campaign for trade in the United Kingdom and in other foreign markets in which British boots and shoes compete with the American product.

BOOT AND SHOE INDUSTRY.

ENGLAND.

The boot and shoe industry in England is carried on chiefly in the towns of Leicester, Northampton, Kettering, London, Leeds, Bristol, Stafford, and Norwich. The industry is gradually growing throughout the country. Conservatively stated, an advance of 10 to 15 per cent has been made during the past five years; with the growth in volume there has also been an improvement in the standard of finished product.

The status of the industry of the United Kingdom is defined in the following tables and statements taken from the latest official census of production, returns being for the year 1907. The following gives the quantity and value of the output:

QUANTITY.

Articles.	England and Wales.	Scotland.	Ireland.	United Kingdom.
	<i>Pairs.</i>	<i>Pairs.</i>	<i>Pairs.</i>	<i>Pairs.</i>
Boots, shoes, and slippers.....	94,169,000	3,050,000	543,000	97,762,000
Clogs.....	1,351,000	66,000	24,000	1,441,000

VALUE.

Boots, shoes, and slippers.....	\$91,704,326	\$4,803,235	\$934,366	\$97,441,929
Clogs.....	744,574	43,798	14,599	802,971
Leggings and gaiters.....	530,448			530,448
Socks for boots and shoes.....	218,992			218,992
Leather laces.....				184,927
Boot and shoe uppers ¹	910,038	19,466	116,796	1,046,297
Parts of boots and shoes other than uppers ¹				978,166
Clog block and clog irons ¹	248,191			248,191
Grindery and mercery ¹	223,859			223,859
Other products.....				141,128
Total value of goods made.....	94,580,425	4,866,499	1,065,763	101,816,908
Repair work.....	7,976,193	1,090,096	213,992	9,286,281
Amount received for work done for the trade (machining, finishing, etc.).....	608,312	14,599	4,866	627,777
Total value of goods made and work done.....	103,164,930	5,971,194	1,289,621	111,739,908

¹ Some of these goods were no doubt sold to retail firms, etc., and consequently their value is an addition to that of the boots, shoes, and slippers, but to a large extent the value of uppers and other parts, at least, is probably returned twice over.

RELATION OF COST OF PRODUCTION TO VALUE OF OUTPUT.

The following table shows the cost of materials used and the amount paid to other firms for work given out to them, in relation to the value of the output:

	England and Wales.	Scotland.	Ireland.	United Kingdom.
Cost of materials used.....	\$63,327,764	\$3,567,144	\$715,375	\$67,610,283
Amount paid to other firms for work.....	481,783	4,866	4,866	491,515
Total.....	63,809,547	3,572,010	720,241	68,101,798
Value of output:				
Goods made for sale.....	94,580,425	4,866,499	1,065,763	101,816,908
Repair work and work done for the trade.....	8,584,505	1,104,695	223,858	9,913,058
Total.....	103,164,930	5,971,194	1,289,621	111,739,908
Value of output less cost of materials used and amount paid to other firms for work.....	39,355,383	2,309,184	569,280	42,233,168

EMPLOYEES—COMPARISON WITH AMERICAN INDUSTRY.

The persons employed in the industry were as follows:

Employees.	England and Wales.	Scotland.	Ireland.	United Kingdom.
Wage earners.....	108,265	7,217	1,842	117,324
Salaried persons.....	8,283	773	184	9,240
Outworkers.....	13,472	155	87	13,714
Total.....	130,020	8,145	2,113	140,278

These tables are based on returns received from factories and work-shops engaged in the manufacture and repair of footwear, whether of leather, india rubber, canvas, or other material. The returns are substantially complete as regards boot and shoe factories where power is employed. They do not include the output of a large number of shops where the occupier works alone, workshops attached to retail shops, and independent repairing shops.

In brief, during 1907 there were manufactured in the United Kingdom 97,762,000 pairs of boots, shoes, and slippers, having a total value of \$97,441,929; the value of goods made in the boot and shoe and allied industries, together with work done for the trade, aggregated \$111,729,966; the cost of materials used was \$67,610,283; and 140,278 persons were employed in the various industries.

For the purpose of comparison the following statement from the census of manufactures of the United States, showing the status of like industries in that country in 1905, is given:

	Average number of wage earners.	Cost of materials used.	Value of products, including custom work and repairing.
Boots and shoes.....	149,924	\$197,363,496	\$320,107,458
Boot and shoe uppers.....	228	290,454	549,867
Boot and shoe findings.....	4,206	6,047,356	9,355,020
Boot and shoe cut stock.....	5,936	21,586,872	27,676,815
Rubber boots and shoes.....	18,991	32,000,464	70,065,296
Total.....	179,285	257,288,641	427,753,456

The gross value of manufactures as reported by the census contains many duplications, because the finished products of some factories become the material for other factories.

LEICESTER THE CENTER OF THE INDUSTRY.

Leicester, with something over 200 factories, large and small, is the principal shoe-manufacturing center in Great Britain. Leicester's product is almost entirely ladies' and misses' boots and shoes, all classes and grades of which are manufactured, including footwear to retail for 3s. 11d. (95 cents) up to 18s. and 20s. (\$4.38 and \$4.86) per pair. These goods are chiefly a medium grade McKay-sewn boot and shoe, and it is claimed that for the grade an equal value can not be given by any other shoe-manufacturing town in the world, a statement possibly open to question, though undoubtedly true as regards wearing qualities.

The output of Goodyear-welt shoes, while small as compared with the McKay-sewn, is growing. Machine and needle sewn nurseries, "veldtschoen," felt house boots and ward shoes, canvas shoes, and leather leggings are all made at this center. Boys' boots and shoes in medium grades are also produced in fair quantities. In the factories of the Leicester district, comprising Absty, Earl Shilton, Barwell, Hinckley, Sileby, Shepshed, Cosby, and Blaby, all rural villages, the production is limited to the more ordinary and cheap lines for ladies, misses, and boys. It is estimated that fully 25,000 hands are employed in the industry in Leicester and district, while the value of the goods produced aggregates \$20,000,000 to \$22,000,000 annually.

The headquarters of the shoe machinery trade of the United Kingdom are located in Leicester, while the manufacture of shoe polishes, shoe laces, shoe merceries (findings) of all kinds, leather dressing, and leather goods is likewise extensive.

It is stated that shoe manufacturing as an industry has been established in Leicester since 1850. American shoemaking machinery was first introduced into England in 1891 by the Union Machinery Co., of Leicester. This firm was agent for several American companies and also manufactured shoemaking machinery, using American machines in certain instances as models.

Conditions in the English boot and shoe industry at that time may be briefly noted. Many factories comprised simply a cutting room and a packing and shipping room. The upper and bottom leathers were purchased and cut up according to orders for varied sorts of footwear. The uppers were given out to be fitted and stitched, then returned to the factory, and again given out with the bottom stock to the laster, or tacker, to be lasted, bottomed, and heeled. The tacker (as he was termed) bought his own grindery (tacks, nails, thread, etc.). The goods were bottomed and shipped or returned, inspected, and passed or rejected by the "taker-in," and once again given out to the finisher for trimming of edges and heels, sandpapering, buffing the bottoms, and finishing. After the final return the products were packed at the factory and shipped.

The operations as described obtained in a large proportion of the shoemaking establishments. However, certain factories were equipped more or less with machinery of a sort very seldom seen in the factory of to-day, and the various operations were accomplished on the premises.

The British United Shoe Machinery Co., whose manufacturing plant has been frequently enlarged since its establishment, Gimson & Co., and the Standard Engineering Co. are manufacturers of shoe machinery located in Leicester, while Johnson et fils, of Paris, France, Moemus, of Frankfurt on the Main, Germany, and the Northampton Shoe Machinery Co., of Northampton, England, have depots in the town.

None of the competing firms produces the complete factory plant put out by the British United Shoe Machinery Co., and it is probable that the share of installed machinery now held by these competing firms is approximately 20 per cent, leaving practically 80 per cent of the equipment to be furnished by the British United Shoe Machinery Co.

OTHER SHOE-MANUFACTURING DISTRICTS.

Northampton ranks second in importance as a seat of modern shoemaking, and is the home for men's superior medium and high grade footwear. The best machine-made boots and shoes manufactured in the United Kingdom are turned out in the factories of this place. In point of value of product it leads all other centers, but Leicester stands first as regards quantity.

In Bristol are manufactured chiefly medium and cheaper goods of all kinds, from a heavy hobnailed boot to a turned slipper, or sew round, the English term for turns.

The output of Leeds' factories comprises chiefly heavy nailed and Standard-screw work, also cheap stitchdowns. In Stafford is made a good class of ladies' footwear in welted, turned, and McKay-sewn. In Norwich turned shoes and slippers, with "veldtschoen" (children's stitchdown sandals), constitute the output. [For list of principal boot and shoe factories in England, see Appendix.]

FACTORY BUILDINGS AND EQUIPMENT.

The English shoe factory is usually a modern brick structure especially built for the purpose, constructed on the one-floor plan, with division partitions between the several departments—clicking or cutting, stitching, bottoming, etc. There are also factories of the American type of construction, with the various departments on different floors.

In some English factories there are still done by hand operations that in the United States would be accomplished by machinery, though the practice is rapidly being discontinued. In some instances upper stitching is given out to home workers during the height of the busy season, when the manufacturer may find his stitching room inadequate to meet the demands. Most English shoe factories, however, are as fully equipped with machinery as are factories in the United States, and the machinery is arranged in like order. In certain instances, however, the system and management necessary to the best results out of up-to-date plant are apparently lacking.

One hardly expects to find the generally conservative Britisher other than a conservative manufacturer, yet in all fairness I would state that while there is among many a tendency to conservatism, the past five or six years have witnessed a marked change in methods and systems. There seems to have been an awakening all along the line, and the results are noticeable not only in increased trade, but also in the style, workmanship, and finish of the product as compared with the article made five or six years ago.

Some English manufacturers are tending toward specialization. Factories where formerly almost everything in footwear was manufactured have either discontinued some of the lines and are directing their energies toward perfecting the one or two continued or have divided the production of the numerous lines into different departments with separate supervision and management. Owners of some recently established factories confine the output of their plants to a certain class, grade, or line of footwear.

NATURE OF OUTPUT.

In discussing the boot and shoe product of Leicester mention was made of the large proportion of McKay-sewn work, and, as may be noted by reference to the list of factories (p. 62), McKay-sewn goods form the principal product of the country. The production of nailed goods follows closely upon McKay-sewn, while the manufacture of Goodyear-welt work is becoming more and more important. Turned footwear is usually produced in court shoes, slippers, and dancing pumps, the work being confined chiefly to these lines for climatic reasons. Many canvas goods are made, a large percentage of which is for the export trade. The center for the manufacture of canvas boots and shoes is the Manchester district, principally the towns of Waterfoot, Bacup, and Rawtenstall. One firm in Leicester (G. Clark & Co.) turns out 33,000 pairs per week during the busy season.

It is claimed that in shoes retailing at the same price a better grade of leather is used in the English than in the American product. As a rule, English-made goods are manufactured from plumper and heavier material than the same style boot or shoe in the United States.

It seems characteristic of the English public to demand solidity rather than flexibility and comfort. There is no tendency to sacrifice wear for style and fit, and the British man or woman demands wear first; yet it must be added that the English manufacturer is making real progress in the art of combining style and fit with durability.

The lasts and heels now used are practically copies of the American articles, but somewhat modified; that is, the outside swing of the last is usually not so extreme, the high toe not so pronounced, etc. The Cuban heel is used for shoes and walking boots, and French heels (modified) for ladies' court shoes and turned slippers.

WORKING HOURS—WAGE SCALE.

The working hours of the English boot and shoe operatives are 52½ per week, it being a general rule to work from 8 a. m. to 1 p. m. and from 2 until 6.30 p. m. each working day except Saturday, when the hours are from 8 a. m. to 1 p. m. These hours continue throughout the year.

In the shoe industry in England the piecework system of payment, while not generally employed as a system, forms according to certain fixed statements the basis upon which all wages are paid. These statements are given in the pages following. Among the terms used may be noted: A golosh is a whole or three-quarter vamp; a square-cut golosh has seam cut square on inside and outside; a derby vamp is a blucher; a golosh quarter is the heel inside part of a three-quarter golosh or heel inside and outside part of a square golosh.

Cutting Department.

DIEING-OUT IN SOLE-LEATHER ROOM.

Articles.	Rate per gross.	Articles.	Rate per gross.
OUTSOLES.		TOPPIECES AND LIFTS (BY MACHINE).	
Men's.....	\$0.24	Women's and girls'.....	* \$0.84
Women's.....	.20	Men's.....	* .72
Sizes 11 to 1.....	.16	If out of offal.....	1.90
Sizes 7 to 10.....	.14	Lifts:	
Sizes 4 to 6.....	.12	Out of pulp.....	* .72
Men's, women's, and boys' toppieces.....	.00	Out of light-belly offal.....	* 1.82
INSOLES.		COUNTERS (FROM BELLIES, BY Mallet).	
Men's, from bellies.....	.24	Men's.....	.26
Boys', 2 to 5, from bellies.....	.21	Women's.....	.22
Women's, from bellies.....	.20	Sizes 11 to 1.....	.18
Sizes 11 to 1.....	.17	Sizes 7 to 10.....	.16
Sizes 7 to 10.....	.15	Sizes 4 to 6.....	.13
Sizes 4 to 6.....	.12	MIDDLE SOLES (FROM BELLIES, BY Mallet).	
Lifts.....	1.02	Women's.....	.22
Men's flesh insoles.....	.20	Sizes 11 to 1.....	.20
Women's.....	.18	Sizes 7 to 10.....	.18
Sizes 11 to 1.....	.16	LIFTS.	
Sizes 7 to 10.....	.14	Red American shanks.....	* .96
Sizes 4 to 6.....	.12	Red American shanks and offal, mixed.....	* 1.20
Socks, leather:		Red American shanks, all offal.....	* 1.44
From skins.....	.24	White lifting, bellies:	
From large offal.....	.36	Wet.....	* .84
If cut from very light fleashes (extra).....	.04	Dry.....	* .96
If cut from offal (extra).....	.02	White offal lifts and half lifts.....	1.02
MIDDLE SOLES.		TOPPIECES (NUMERIES).	
Men's.....	.18	From large offal.....	{ 1.015
Boys', 2 to 5.....	.16		{ 1.68
Women's.....	.15	From small offal.....	{ 1.02
Sizes 11 to 1.....	.13		{ 2.24
Sizes 7 to 10.....	.12	PUFFS.	
Sizes 4 to 6.....	.11	Men's.....	{ 1.08
Lifts run in.....	1.02		{ 2.36
COUNTERS.		Women's.....	{ 1.04
Men's.....	.19		{ 4.48
Women's.....	.17	Women's, from offal.....	{ 1.05
Sizes 11 to 1.....	.13		{ 5.60
Sizes 7 to 10.....	.11	SOCKS (PAPER).	
Sizes 4 to 6.....	.09	12 pairs at a time.....	.02
Lifts run in.....	1.02	Side linings, 6 pairs at a time.....	.04
COUNTER BACKERS.		Canvas puffs.....	.02
All sizes.....	.08	CANVASBOARD INSOLES (1 PAIR AT TIME).	
If cut out of flesh, two pairs at a time.....	.04	Men's.....	.08
COMPOSITION AND CARDBOARD SQUARES.		Women's.....	.075
Insoles and middle soles:		Sizes 11 to 1.....	.06
One pair at a time.....	.08	Sizes 7 to 10.....	.05
Cut single.....	.12	Sizes 4 to 6.....	.04
Cardboard, or Ashfelt fillers.....	.04		
Lifts, 1 pair at a time.....	1.01		

* Per pound.

* Per hundredweight.

Cutting Department—Continued.

CUTTING MEN'S AND BOYS' BOOTS AND SHOES.

[Prices apply to two classes and vary slightly. The first class includes the following leathers: Glove kid, glazed kid, calf kid, wax calf, colored calf, colored chrome calf, cow calf, box calf, willow calf, levant seal, levant goat, glazed goat. Four cents per dozen extra over first class for glove and glazed kid, being 2 cents per dozen on boot legs and shoe quarters, and 2 cents per dozen on vamps; these extras apply to all sizes. The second class includes brown hide, box hide, wax splits, satin hide, glove hide, box kip, wax kip, and mock buck. The terms boots and shoes correspond, respectively, to the American high cuts and low cuts, or oxfords.]

Articles.	Rate per dozen.			
	Men's.	Sizes 2-5.	Sizes 11-1.	Sizes 7-10.
BOOTS, FIRST CLASS.				
Whole-cut golosh.....	\$0.20	\$0.15	\$0.12	\$0.10
Square-cut golosh vamp.....	.11	.10	.08	.07
Circular vamp.....	.10	.09	.07	.06
Derby vamp.....	.13	.11	.08	.07
Golosh quarter.....	.08	.06	.05	.04
Golosh elastic side and bal leg and back strap.....	.18	.16	.14	.13
Ordinary bal leg, not goloshed.....	.20	.17	.15	.14
Derby bal leg, not goloshed.....	.22	.18	.16	.15
Whole-cut Chelsea.....	.20	.18	.16	.14
Rounding by general rounder.....	.06	.07	.06	.06
Joined side Chelsea.....	.24	.20	.18	.16
Rounding joined side Chelsea by general rounder.....	.04	.04	.04	.04
Round-peak cap.....	.04	.04	.04	.04
Peak-wing cap.....	.04	.04	.04	.04
Pointed-peak cap.....	.03	.03	.03	.03
Straight cap.....	.03	.03	.03	.03
Button bit, plain, not scooped.....	.05	.04	.04	.04
Bellows tongues.....	.08	.06	.06	.06
Ordinary tongues.....	.02	.02	.02	.02
Leather linings to toes.....	.16	.14	.13	.10
Leather linings, toes off.....	.14	.12	.10	.08
Toe joiners, 48 to the dozen.....	.04	.04	.04	.04
Inside facings.....	.04	.04	.04	.04
Outside facings.....	.04	.04	.04	.04
Top bands.....	.03	.03	.03	.03
Button bit linings, 24 to the dozen.....	.02	.02	.02	.02
Linen linings.....	.02	.03	.015	.015
Linen linings when cutter cuts own linings.....	.025	.025	.02	.02
SHOES, FIRST CLASS.				
Derby vamps.....	.13	.11	.08	.07
Circular vamps.....	.10	.09	.07	.06
Whole-cut and cycle shoes.....	.18	.16		
Facings for same.....	.06	.04		
Golosh, laced, and elastic side quarters.....	.13	.11	.09	.08
Ordinary quarters.....	.14	.12	.10	.09
Button bits.....	.04	.04	.04	.04
Ordinary tongues.....	.02	.02	.02	.02
Leather linings to toes.....	.10	.08	.07	.07
Leather linings, toes off.....	.08	.06	.06	.06
Toe joiners, 48 to the dozen.....	.04	.04	.04	.04
Linen vamp linings.....	.03	.03	.03	.03
Outside facings.....	.04	.04	.04	.04
Button bit linings.....	.02	.02	.02	.02
Round-peak cap.....	.04	.04	.04	.04
Peak-wing cap.....	.04	.04	.04	.04
Pointed-peak cap.....	.03	.03	.03	.03
Straight cap.....	.03	.03	.03	.03
Wing-peak vamp.....	.06	.06	.06	.06
Outside wing facings.....	.06	.06	.06	.06
Back straps.....	.02	.02	.02	.02
BOOTS, SECOND CLASS.				
Whole-cut golosh.....	.16	.14	.12	.10
Square-cut golosh vamp.....	.10	.08	.07	.06
Circular vamp.....	.09	.07	.06	.05
Derby vamp.....	.11	.09	.07	.06
Golosh quarter.....	.06	.06	.06	.04
Golosh elastic side and bal leg and back strap.....	.16	.14	.12	.11
Ordinary bal leg, not goloshed.....	.18	.16	.14	.13
Derby bal leg, not goloshed.....	.20	.17	.15	.13
Whole-cut Chelsea.....	.18	.16	.14	.13
Rounding by general rounder.....	.08	.07	.06	.06
Joined side Chelsea.....	.22	.18	.16	.15
Rounding joined side.....	.04	.04	.04	.04
Round-peak cap.....	.04	.04	.04	.04

Cutting Department—Continued.

CUTTING MEN'S AND BOYS' BOOTS AND SHOES—Continued.

Articles.	Rate per dozen.			
	Men's.	Sizes 2-5.	Sizes 11-1.	Sizes 7-10.
BOOTS, SECOND CLASS—continued.				
Peak-wing cap.....	\$0.04	\$0.04	\$0.04	\$0.03
Pointed-peak cap.....	.03	.03	.03	.02
Straight cap.....	.03	.03	.03	.02
Button bit, plain.....	.05	.04	.04	.04
Belows tongues.....	.08	.08	.08	.06
Ordinary tongues.....	.02	.02	.02	.02
Leather linings to toes.....	.16	.14	.12	.10
Leather linings, toes off.....	.14	.12	.10	.08
Toe joiners, 48 to the dozen.....	.04	.04	.04	.04
Inside facings.....	.04	.04	.04	.04
Outside facings.....	.04	.04	.04	.04
Top bands.....	.03	.03	.03	.03
Button bit linings, 24 to the dozen.....	.02	.02	.02	.02
Linen linings.....	.02	.02	.015	.015
Linen linings when cutter cuts own linings.....	.025	.025	.02	.02
SHOES, SECOND CLASS.				
Derby vamps.....	.11	.09	.07	.06
Circular vamps.....	.09	.07	.06	.05
Whole-cut and cycle shoes.....	.14	.12		
Facings for same.....	.06	.04		
Golosh, laced, and elastic side quarters.....	.12	.10	.08	.07
Ordinary quarter.....	.13	.11	.09	.08
Derby.....	.13	.11	.09	.08
Button bits.....	.04	.04	.04	.04
Tongues, ordinary.....	.02	.02	.02	.02
Leather linings to toes.....	.10	.08	.07	.07
Leather linings, toes off.....	.08	.06	.05	.05
Toe joiners, 48 to the dozen.....	.04	.04	.04	.04
Linen vamp linings.....	.03	.03	.03	.03
Outside facings.....	.04	.04	.04	.04
Button bit linings.....	.02	.02	.02	.02
Round-peak cap.....	.04	.04	.04	.04
Peak-wing cap.....	.04	.04	.04	.03
Pointed-peak cap.....	.03	.03	.03	.02
Straight cap.....	.03	.03	.03	.02
Wing-peak vamp.....	.08	.08	.08	.08
Outside wing facings.....	.06	.06	.06	.06
Back straps.....	.02	.02	.02	.02

CUTTING TENNIS AND CANVAS SHOES.

Articles.	Rate per dozen.		
	Men's.	Sizes 2-5.	Sizes 11-1.
BY HAND.			
Bodies, 1 pair at a time, plain.....	\$0.05	\$0.05	\$0.04
One and two bar shoes, 4 to a pair.....	.08	.08	.07
Quarters, 4 to a pair.....	.05	.05	.04
Circular vamps, 2 to a pair.....	.03	.03	.02
Button and buttonhole stays.....	.02	.02	.02
Canvas tongues, 2 to a pair.....	.01	.01	.01
Straight caps.....	.03	.02	.02
Pointed caps.....	.03	.03	.03
Round peak caps.....	.04	.04	.04
Joint straps.....	.06	.06	.05
Outside facings, 2 to a pair.....	.06	.06	.06
Inside facings, 2 to a pair.....	.04	.04	.04
Tongues.....	.02	.02	.02
Side linings.....	.04	.04	.04
Outside counters, 2 to a pair.....	.05	.045	.04
Outside counters, 4 to a pair.....	.07	.065	.06
Outside back straps.....	.02	.02	.02
Marking size.....	.02	.02	.02

NOTE.—Sizes 7 to 10 are 2 cents per dozen less than 11 to 1 on total. Women's sizes 2 to 5 same as boys', except sizes 4 to 10 are 2 cents less per dozen than sizes 11 to 1 on total.

Cutting Department—Continued.

CUTTING WITH MALLET AND PRESS.

Articles.	Rate per gross.		
	Men's.	Sizes 2-5.	Sizes 7-1.
WITH MALLET.			
Caps.....	\$0.23	\$0.16	\$0.14
Joint straps.....	.30	.24	.23
Outside facings, 2 to a pair.....	.23	.16	.14
Inside facings, 2 to a pair.....	.14	.13	.13
Inside facings, 4 to a pair.....	.24	.24	.24
Tongues.....	.16	.14	.13
Side linings.....	.20	.20	.20
Back straps.....	.10	.08	.08
Outside counters, 2 to a pair.....	.30	.28	.26
Outside counters, 4 to a pair.....	.44	.44	.43
Marking size.....	.24	.24	.24
WITH PRESS.			
Tennis uppers, 4 pairs at a time.....	.14	.12	.10
Socks, all sizes, 12 pairs at a time.....	.03	.02	.02

NOTE.—Women's cut with mallet same per dozen as boys'.

CUTTING BICYCLE SHOE FITTINGS.

Articles.	Rate per dozen.	Articles.	Rate per dozen.
Outside facings, 2 to a pair, plain.....	\$0.06	Tongues.....	\$0.02
Inside counters.....	.04	Caps.....	.04
Marking for counters.....	.02	Inside facings, 2 to a pair.....	.04
Inside facing stays, 4 to a pair.....	.03	Pricking.....	.01
Bindings.....	.02	Marking size on toe.....	.01

SKIVING (MEN'S).

Whole-cut Chelsea kid and glove kid, turned in gore.....	\$0.09	Elastic side tops.....	\$0.02
Elastic side golosh tops, skived round bottom and edged back, turned in gore.....	.06	Side linings.....	.03
Vamp, turned in.....	.04	Heel straps.....	.03
Bal tops, skived all round.....	.04	Goloshed back strap, turned in.....	.03
Top bands and facings, turned in.....	.04	Facings edged at bottom.....	.03
Boot linings, turned in.....	.04	Cap, edged at bottom.....	.03
Golosh, turned in.....	.03	Top bits for elastic side.....	.03
Shoe linings, turned in.....	.03	Button bits.....	.03
Vamp, edged.....	.02	Tongue.....	.03
Golosh, edged.....	.02	Button caps.....	.03
Bal quarter, skived round bottom and edged back.....	.02	Skiving vamps for lasters.....	.04

Cutting Department—Continued.

CUTTING WOMEN'S AND GIRLS' BOOTS AND SHOES.

[First class applies to following leathers: Colored calf, glove kid, glazed kid, ooze calf, chrome glazed kid, 60 feet per dozen and under. Chrome glazed kid, over 60 feet per dozen, are paid for as seconds, with an additional 4 cents per dozen above seconds price. Second class includes patent calf, wax kip, calf kid, wax calf, box calf, dongola, Persians, mock glove kid, glazed sheep and Persians, box hide, box kip. Third class includes hard-dressed glazed sheep and Persians, levant kip, plain sheep, glove and satin hide, wax splits, and levant goat.]

Articles.	Rate per dozen.					
	First class.		Second class.		Third class.	
	Wom- en's.	Sizes 11-1.	Wom- en's.	Sizes 11-1.	Wom- en's.	Sizes 11-1.
BOOTS.						
Underlaid vamps.....	\$0.14	\$0.12	\$0.12	\$0.10	\$0.08	\$0.07
Derby and square vamps.....	.14	.12	.12	.10	.08	.07
Circular vamps.....	.12	.10	.10	.08	.06	.05
Whole and three-quarter cut golosh.....	.24	.17	.16	.12	.12	.10
Golosh quarters.....	.06	.07	.06	.05	.06	.05
Tops.....	.24	.22	.20	.18	.16	.14
Tops, derbys.....	.26	.24	.22	.20	.18	.16
Golosh tops.....	.23	.21	.19	.17	.15	.13
Cloth tops, 4 at a time.....	.07	.05	.06	.04	.06	.04
Button bits.....	.06	.06	.06	.05	.06	.05
Leather linings to toes.....	.16	.12	.16	.12	.16	.12
Leather linings, toes off.....	.14	.10	.14	.10	.14	.10
Leather toe joiners, 48 to dozen.....	.04	.04	.04	.04	.04	.04
Leather toe joiners, 24 to dozen.....	.02	.02	.02	.02	.02	.02
Linen linings.....	.02	.015	.02	.015	.02	.015
Inside facings.....	.36	.03	.05	.03	.05	.03
Top bands.....	.03	.02	.03	.02	.03	.02
Tongues.....	.02	.02	.02	.02	.02	.02
Tongue linings.....	.01	.01	.01	.01	.01	.01
Button bit linings, 24 to the dozen.....	.025	.02	.025	.02	.025	.02
SHOES.						
Underlaid vamps.....	.14	.12	.12	.10	.08	.07
Derby and square-cut vamps.....	.14	.12	.12	.10	.08	.07
Circular vamps.....	.12	.10	.10	.18	.06	.05
Whole-cut and cycle shoes.....	.24	.17	.16	.12	.12	.10
Outside facings for same.....	.08	.06	.07	.05	.06	.05
Quarters.....	.15	.13	.13	.10	.10	.08
Quarters to caps.....	.26	.19	.18	.14	.14	.12
Quarters to derbys.....	.16	.14	.14	.11	.11	.09
Button bits.....	.05	.05	.045	.045	.04	.04
Vamp linings.....	.01	.01	.01	.01	.01	.01
Tongue linings.....	.01	.01	.01	.01	.01	.01
Tongues.....	.02	.02	.02	.02	.02	.02
Button bit linings.....	.02	.02	.02	.02	.02	.02
Leather linings to toes.....	.08	.07	.08	.07	.08	.07
Leather linings, toes off.....	.06	.05	.06	.05	.06	.05
Toe joiners, 48 to dozen.....	.04	.04	.04	.04	.04	.04
Caps:						
Round peak.....	.05	.05	.045	.045	.04	.04
Pointed peak.....	.04	.04	.035	.035	.03	.03
Straight.....	.03	.03	.025	.025	.02	.02

Cutting Department—Continued.

SKIING (WOMEN'S).

Articles.	Rate.	Articles.	Rate.
	<i>Per dozen.</i>		<i>Per dozen.</i>
Elastic side top, back edged at bottom of gore, turned in gore.....	\$0.06	Bai top (top of top only), turned in.....	\$0.02
Derby (shoe) quarters, turned in all round.....	.04	Side linings.....	.01
Boot linings, turned in.....	.04	Heel strap.....	.01
Oxford shoe quarters, skived all round.....	.035	Goloshed back strap, turned in.....	.01
Golosh, turned in.....	.08	Caps edged.....	.01
Vamp, turned in.....	.03	Facings edged at bottom.....	.01
Bal or other tops, turned in over vamp.....	.03	Bal top, skived at bottom for vamp.....	.01
Shoe quarter linings turned in.....	.025	Blocked fronts, turned in over cap.....	.015
Facings, turned in, edged at bottom.....	.02	Elastic side top bits.....	.01
Top bands, turned in.....	.02	Button bits.....	.01
Golosh, edged.....	.02	Tongue.....	.01
Vamp, edged.....	.02	Edging bal or button tops.....	.03
Golosh bal top, skived at bottom.....	.02	Oxford or button shoe quarters.....	.025
Elastic side top, back edged at bottom of gore, and skived for vamp.....	.02	Button caps.....	.08
		Skiving vamps for lasters.....	.04

CUTTING WITH PRESS.

TENNIS UPPIERS.	<i>Per gross.</i>	LININGS—continued.	<i>Per gross.</i>
Women's (2 to 5), 4 pairs at a time.....	\$0.12	Tongue linings, 12 pairs at a time.....	\$0.03
Girls' (7 to 1), 4 pairs at a time.....	.10	Women's side linings, 6 pairs at a time.....	.015
Girls' (4 to 6), 4 pairs at a time.....	.08	Girls' side linings, 6 pairs at a time.....	.01
		Velvet, 2 pairs at a time.....	.24
		Cashmere, 4 pairs at a time.....	.12
		Venetian, 4 pairs at a time.....	.18
		SOCKS.	
		All sizes, 12 pairs at a time.....	.02

CUTTING WOMEN'S AND MISSES' SLIPPERS AND DRESS SHOES.

Articles.	Rate per dozen.		
	1st class.	2d class.	3d class.
Vamp.....	\$0.12	\$0.11	\$0.08
Quarter.....	.07	.05	.05
Leather lining.....	.04	.04	.04

Stitching Department.

FINE AND MEDIUM CLASS WORK.

Operations.	Rate.	Operations.	Rate.
CLOSING.		RUNNING ROUND—continued.	
Machine row on facings, plain: ¹	<i>Per dozen.</i>	Stitched soles, 8 or 9 holes.....	<i>Per dozen.</i>
Boots.....	\$0.03	Extra holes each (extra).....	\$0.12
Shoes.....	.02	Machining all punched rows (extra)...	.03
Closing quarters on back seams:		Running round all shaped tops (extra)...	.02
Boots.....	.02	Running round button bits, peaked	
Shoes.....	.015	(8 or 9), stuck on.....	.06
Closing all golosh seams, side or back:		Running with or without beading,	
Raw edge.....	.015	scolloped.....	.06
Turned in.....	.02	Bagged button bits, peaked or scol-	
Closing on button bits (unlined) on		loped (extra 2 cents).....	.07
quarters:		Bagged work, running round strap	
Boots.....	.03	shoes:	
Lower-grade boots.....	.025	1 bar.....	.07
Closing on button bits (lined) on		2 bar.....	.10
quarters:		Semi-Trinity shoes, same as 2 bars....	.10
Boots.....	.04	Trinity shoes (extra 2 cents).....	.12
Lower-grade boots.....	.03	Strap shoes (per hole).....	.02
Closing on button bits, shoes.....	.02	Strap shoes in trimmer:	
Closing button bit, lining to lining		Holding and machining on (turned	
Boots.....	.03	in quarters)—	
Shoes.....	.015	1 bar.....	.13
Closing back seam of derby golf boots..	.03	2 bars.....	.17
Closing on for bagging machine:		3 bars.....	.22
Tops (straight) boots.....	.03	Trimming corners of straps by	
Tops (shaped) boots.....	.05	hand—	
Tops, all round bals, boots.....	.09	1 bar (extra).....	.02
Tops only, deep-bagged shoes.....	.04	2 bars (extra).....	.03
Closing all round, shoes:		3 bars (extra).....	.04
Ordinary bagged.....	.06	VAMPS, ETC.—TWIN-NEEDLE MACHINE.	
Deep bagged.....	.06	Holding and machining on:	
Peaked button bits boots.....	.07	Vamps, plain.....	.07
Peaked button bits shoes.....	.04	Whole golosh—	
Scolloped button bits boots.....	.09	When prepared.....	.19
Scolloped button bits shoes.....	.05	When lower grade.....	.18
Along top to end of strap, 1-bar shoe..	.05	Not prepared.....	.243
All round:		Derby vamps held on:	
1-bar shoe.....	.09	Boots.....	.15
2-bar shoe.....	.12	Shoes.....	.11
Closing fronts:		Staying (extra).....	.04
If laid over.....	.01	Derby vamps, when stuck in:	
When closed for silking.....	.03	Boots.....	.10
Joining straps (laid over).....	.01	Shoes.....	.09
Semi-Trinity shoes, same as 2-bar.....	.12	French or straight golosh, held on....	.07
Trinity shoes (extra 2 cents).....	.14	Derby golosh, held on.....	.09
RUNNING ROUND.²		Straight caps, held on (without	
Running round bals:		puffs).....	.08
Boots (in trimmer).....	.08	Half-peaked caps, held on.....	.04
Boots, bagged.....	.07	Long-peaked caps:	
Button boot.....	.06	Held on.....	.07
Turning in side:		Stuck on.....	.06
Button boot.....	.03	Winged caps.....	.08
Bals, both sides.....	.08	Caps with puffs held in (extra).....	.02
Running round:		VAMPS, ETC.—SINGLE-NEEDLE	
Button boot, including button bit.	.15	MACHINE.	
If button bit be held on (extra		Ordinary back strap, 1 row.....	.08
2 cents).....	.17	Back strap on the round.....	.12
Bal shoes, ordinary.....	.04	Small back strap, turned in.....	.085
Shoes, deep bagged.....	.05	Shoe back strap, turned in (shaped)...	.085
Top and side of button shoe, ordinary.	.03	Holding and machining on straight	
Along top only of button shoe, deep		caps:	
bagged.....	.04	Without puffs.....	.04
Gibson shoe complete, unlined tongues		With puffs.....	.06
or ready bound.....	.08	Jockey back straps.....	.12
Running round goloshed golf boots		Silking back seam of golf boot half way	
(held on).....	.19	down.....	.03
Holding and machining on golosh on		Silking side seam of goloshes and trim-	
the round.....	.16	ming off.....	.02
Fronts and machining on golosh on			
the round.....	.12		

¹ Fancy facings on boots and shoes according to design; all peaks or curves one-half cent extra each.² All high-legged work to be paid extra. All high-legged 6's to be paid for as women's. All extra high-legged work to be paid extra according to height, each inch to count an extra. Sizes: 14 pairs of sizes 7 to 1 and 15 pairs of sizes 4 to 6 to be counted as 1 dozen women's. All women over 18 years old are paid not less than 8 to 10 cents per hour for skilled labor, according to ability of operator; unskilled, not less than 7 to 8 cents per hour when on time wages.

Stitching Department—Continued.

FINE AND MEDIUM CLASS WORK—Continued.

Operations.	Rate.	Operations.	Rate.
VAMPS, ETC.—SINGLE-NEEDLE MACHINE—Continued.		LININGS, ETC.	
Ordinary goloesh:	<i>Per dozen.</i>	Making linings, per seam:	<i>Per dozen.</i>
Plain, 2 rows.....	\$0.08	Boots.....	\$0.015
2 peaks.....	.10	Shoes.....	.01
Wing caps, stuck on.....	.08	Holding and machining on toe linings:	
Punched vamps, held on.....	.10	Ordinary.....	.03
Holding and machining on derby vamps, 2 rows, and staying:		Lower grade.....	.025
Boots.....	.243	Ribbon or silk top bands:	
Shoes.....	.20	Closing, cutting up, and flattening out.....	.015
Derby vamps, when stuck in:		Holding and machining on.....	.03
Boots.....	.15	Leather top bands:	
Shoes.....	.11	Closing, cutting up, and flattening out.....	.01
All extra rows, plain or punched, on vamps, goloeshes, or facings (extra).....	.08	Holding and machining on.....	.025
Joining goloesh on to quarters, ready for back strap.....	.06	Tacking:	
Holding and machining on all round goloesh:		By hand.....	.02
Punched.....	.26	In machine.....	.015
Lower grade.....	.243	Preparing linings, clipping on bits.....	.02
Running round holes or slits in strap shoes:		Button stays, facing stays or strips.....	.02
Small, each.....	.02	Marking facings.....	.02
Ordinary, each.....	.03	Closing toes and putting in tongues.....	.03
Running round or square corners.....	.04	Backers, half moons and stay bits.....	.04
Running heart in cross bars.....	.04	Side linings.....	.02
		Holding and machining on inside facings:	
CLOSING ON FOR BAGGING.		Ordinary.....	.045
Bals along top.....	<i>Per gross.</i>	Derbys.....	.065
Button boots:	.36	Closing button bit linings, per seam:	
Along top and under side.....	.60	Ordinary.....	.01
With wavy button bit.....	1.45	Lower grade.....	.005
With straight button bit.....	1.21	Cutting up and flattening out.....	.005
Lace shoes along top:		Closing toes of derby boot linings.....	.02
Deep bagged.....	.49	Holding tongues in derby boots and trimming off.....	.04
If bagged level.....	.12	Holding on and lining tongues:	
Button shoes along top and underside:		Ordinary boots.....	.03
Deep bagged.....	.60	Shoes.....	.015
If bagged level.....	.12	Derbys—	
Lace shoes, all round.....	.55	Boots.....	.04
Button shoes, all round.....	.73	Shoes.....	.02
		Nicking (2 cents) and turning (2 cents).....	.04
MACHINING ROUND BAGGED WORK.		Shading or lettering brown work.....	.02
Bals, all round, when prepared and no fixing required.....	.73	Holding and machining in vamp lining.....	.03
Button bits, all round:		Cleaning of boots and shoes.....	.04
Wavy button bit.....	1.21	Cutting up and tying up only.....	.01
Reverse button bit.....	1.45	Nicking button boot lining:	
Button boot:		Down side when closing on button bit.....	.01
Straight button bit.....	1.10	At end of button bit for turned up linings.....	.01
If bit be held on.....	1.21	Holding in puffs in caps.....	.02
Lace shoes, all round (deep and level bagged).....	.49	Cutting lining and flattening top bands at top of button bit when closing on.....	.02
Button shoes, all round:		Trimming of button stays.....	.01
Wavy button bit.....	.60	Closing, cutting up, and flattening out inside facings.....	.02
Reverse button bit.....	.73		
		NOTE. —Counting work, one-half cent per dozen items. All work to be ready sorted and placed in sizes for operator.	
BAGGING IN BAGGING MACHINE.		LUFKIN FOLDER.	
Along top of button or bal boots.....	<i>Per dozen.</i>	Vamps, plain:	<i>Per gross.</i>
Shaped tops.....	.035	Fine.....	.42
All round ordinary bal boots.....	.05	Lower grade.....	.36
Shaped tops.....	.07	Lowest grade.....	.30
Bal shoes:		Caps, straight.....	.18
Ordinary.....	.035	Lower grade.....	.13
Deep bagged.....	.06	Caps, peaked.....	.36
Top and side of button shoes:		Lower grade.....	.30
Ordinary.....	.085	Quarters, ordinary, boot facings.....	.42
Deep bagged.....	.045	Lower grade.....	.36
Button bits, peaked or scalloped.....	.07	Quarters, derbys, including corner.....	.73
High-legged (extra 2 cents).....	.09	Lower grade.....	.60
Strap shoes:		Gibson shoes, without under quarters.....	.73
1 bar.....	.08		
2 bar.....	.10		
Every extra bar (extra).....	.02		
Semi-Trinity, same as 2 bar.....	.10		
Trinity (extra 2 cents).....	.12		

Stitching Department—Continued.

FINE AND MEDIUM CLASS WORK—Continued.

Operations.	Rate.	Operations.	Rate.
LUFKIN FOLDER—continued.		SILKING MACHINE, LOCK STITCH—CON.	
All round golosh.....	<i>Per gross.</i> \$0.73	Side or back seams, goloshes or shoes..	<i>Per dozen.</i> \$0.015
Lower grade.....	.65	Button bits, fronts, through linings:	
Straight or French golosh.....	.36	Boots.....	.08
Counter golosh.....	.46	Shoes.....	.02
Lower grade.....	.42		
Peaked golosh.....	.73	STANBON PUNCHING MACHINE.	<i>Per gross.</i>
Button bits, peaked:		Vamps, ordinary.....	.243
Boots.....	1.46	Lower grade.....	.20
Lower grade.....	1.21	Lowest grade.....	.18
Shoes.....	.73	When reverse, measuring and com-	
Lower grade.....	.49	mencing twice (extra).....	.04
Shoe facings.....	.36	Golosh, ordinary.....	.20
Winged caps.....	.67	Lower grade.....	.17
Lower grade.....	.60	Counter golosh (extra).....	.04
Jockey back straps.....	1.21	All round golosh.....	.36
Lower grade.....	1.09	Lower grade.....	.32
Ordinary back straps.....	.49	When reverse (extra).....	.04
Shoe.....	.243	Golf golosh.....	.32
Underlaid quarters.....	.49	Lower grade.....	.30
Golf boots, ordinary.....	1.09	Boot facings:	
Lower grade.....	1.03	Ordinary.....	.44
NOTE.—All pasting or solution to be		Lower grade.....	.40
paid for at the rate of one-half cent		Derbys (extra).....	.04
per dozen items or 6 cents per gross.		Shoe facings:	
ZIGZAG MACHINE.		Ordinary.....	.22
Holding and machining on:	<i>Per dozen.</i>	Lower grade.....	.20
Leather top bands.....	.03	Derbys (extra).....	.02
Silk or ribbon top bands.....	.04	Caps, ordinary.....	.12
Machining on top bands, when stuck on.	.025	Lower grade.....	.10
		Lowest grade.....	.08
		Winged caps.....	.32
		Lower grade.....	.30
FEATHERSTITCH MACHINE.		BUTTONHOLE MACHINE.	<i>Per 1,000</i>
Machining on top bands:		High-speed Reece, with barring appa-	<i>holes.</i>
When stuck on.....	.04	ratus.....	.30
When held on.....	.06	Lower-grade work.....	.26
BOOTH FOLDER.	<i>Per gross.</i>	EYELETING MACHINE.	<i>Per dozen.</i>
Straight caps.....	.06	Women's boots:	
Half-peaked caps.....	.12	Ordinary.....	.03
Peaked caps.....	.18	Derby.....	.06
Goloshes, plain.....	.18	Women's shoes:	
Boot facings.....	.243	Ordinary.....	.02
Reverse button bits.....	.243-.73	Derby.....	.03
Top bands.....	.12	Eyeletting halfway up when punched	
Derby quarters, all round.....	.73	separately, boots.....	.045
SILKING MACHINE, LOCK STITCH.	<i>Per dozen.</i>	Punching out for studding, boots.....	.03
Front and back seams, boots.....	.025	Hooking halfway up.....	.025
Back seams when goloshed, boots.....	.03	Studding halfway up.....	.025
		Eyeletting boys' boots.....	.03

COMMON CLASS AND HEAVY WORK.

CLOSING, ETC.		CLOSING, ETC.—continued.	
Machine row on facings, plain: ¹	<i>Per gross.</i>	Closing top and side of button boot:	<i>Per gross.</i>
Boots.....	\$0.30	Straight.....	\$0.61
Shoes.....	.18	Shaped.....	.86
Closing quarters, back seams:		Closing top and side of button shoe.....	.30
Boots.....	.243	Running round, in trimmer:	
Shoes.....	.18	Bal boots.....	.74
Closing side or back seams of goloshes:		Derby boots.....	.97
Raw edge.....	.18	Running round button.....	.61
Turned in.....	.243	Turning in sides and nicking lining.....	.30
Closing on button bits on quarters or		Running round bal shoes:	
linings:		Ordinary.....	.30
Boots.....	.30	Deep bagged.....	.49
Shoes.....	.18	Small back strap, one row:	
Closing on tops for bagging:		Turned in.....	.06
Straight.....	.36	Raw edge.....	.06
Shaped (extra 24.3 cents).....	.61		
Closing all round:			
Bal boots.....	.86		
Shoes.....	.49		

¹ Fancy facings on boots and shoes according to design; all peaks or curves one-half cent extra each.

20 SHOE AND LEATHER TRADE IN THE UNITED KINGDOM.

Stitching Department—Continued.

UNION SPECIAL.

Operations.	Rate.	Operations.	Rate.
SILKING MACHINE—SWIFT CHAIN STITCH.		OTHER.	
Back seams of boots, ordinary.....	<i>Per gross.</i> \$0.20	Running round scolloped button bits:	<i>Per gross.</i>
Button bit front or back seams, when		Boots—	
goloshed.....	.243	When stuck on.....	\$0.61
Button bit fronts, through linings.....	.30	When held on (extra 24.3 cents)	.85
Golosh seams, back or side.....	.12	Shoes—	
Shoe seams, backs or fronts.....	.14	When stuck on.....	.32
Shoe button bit fronts, through linings.....	.18	When held on.....	.43
Shoe linings.....	.12	Cutting round by hand.....	.30
Leather linings, boots.....	.18	Silking golosh seams in single-needle	
		machine.....	.243
TWIN-NEEDLE MACHINE.			
Holding and machining on:			
Caps—			
Straight.....	.30		
With puffs.....	.40		
Half peaked.....	.61		
Vamps, plain, through lining.....	.74		
Goloshes, plain.....	.61		

Finishing in conjunction with machinery.

[All samples and specials are reckoned 9 pairs to the dozen.]

WOMEN'S ORDINARY.

Operations.	Rate.	Operations.	Rate.
PUTTING IN LASTS, HINGED OR SOLID BLOCK.		FOREPART PARING—continued.	
Lasts to be assorted for use, by hand	<i>Per dozen.</i>	Welts plowed out:	<i>Per dozen.</i>
or on stand.....	\$0.02	Wetted and fair stitched.....	\$0.05
Lasts when not assorted for use.....	.01	Bevels.....	.07
By aid of machine or jack.....	.015	Half-wide welts (extra).....	.008
Lasts with loose blocks (extra).....	.01		
Work tied over or buttoned, two lace		HEEL SCOURING.	
holes or three buttons (extra).....	.02	Rough and fine scouring by one man	
		on same machine (heels 1½ inches	
HEEL PARING.¹		high, finished).....	.04
Trimming heels and randing same on		Heels over 1½ inches high (extra).....	.015
Smith or similar machine.....	.03	Wurtemburgs (not Louis heels).....	.13
Wurtemburgs (not Louis heels).....	.065	Iron heel plates (extra).....	.01
Heels over 1½ inches high (extra).....	.005	Brass plate insertion, or rubber inser-	
Paring heels with rubber insertions or		tion, or revolving rubber toppiece	
revolving rubber toppieces (extra).....	.005	(extra).....	.008
		Gumming or damping heels with any	
FLOWING OUT BY HAND.		liquid preparation (extra).....	.015
Foreparts only, machine sewn and		Fine scouring after wetting, copper	
riveted.....	.015	sizing, or gumming (a second time).....	.02
Waists only, machine sewn and riv-		Scouring burr of toppiece when done	
eted.....	.01	by heel sourer (extra).....	.005
Seats only.....	.01		
Wetted:		HEEL TRIMMING.²	
Foreparts only.....	.025	By hand.....	.03
Waists only.....	.015	Buffing fronts of heels, by hand.....	.02
Fair stitched:		Buffing soles in fronts of heels, by hand.....	.01
Foreparts only.....	.02	Cutting bottom lifts of heels, by hand.....	.02
Waists.....	.01	Cutting waists partly down after par-	
Half-wide welts (extra).....	.02	ing, by hand (extra).....	.02
Opening welts not plowed out:		Rebreasting heels, with knife.....	.04
Foreparts.....	.015		
Waists.....	.01	HEEL BURNISHING.³	
Twice plowing, foreparts only (extra).....	.015	Rockingham or pad and brush, by	
		machine.....	.025
FOREPART PARING.		Wurtemburgs (not Louis heels).....	.05
Foreparts and waists on Russell or		If faked by hand (extra).....	.01
similar machine.....	.04	Heel burnishing, seat wheeling com-	
		bined, pad or brush.....	.005

¹ Extra for sharpening knives (to the heel parer only), 24 cents per week per man.

² Definition: Clearing breast of heels, cutting down corners, and bit waist front of heel. Heels to be breasted before attached.

³ Heels colored for the men.

Finishing in conjunction with machinery—Continued.

WOMEN'S ORDINARY—Continued.

Operations.	Rate.	Operations.	Rate.		
SEAT WHEELING.		CLEANING STITCHES (FOREPARTS ONLY).			
By machine.....	<i>Per dozen.</i> \$0.015	Gumming, boning, and polishing the same.....	<i>Per dozen.</i> \$0.06		
By hand.....	.04	Coloring welts, liquid color (extra)....	.02		
Wurtemburgs (not Louis heels):		PRICKING UP STITCHES (FOREPARTS ONLY).			
By machine (extra).....	.006	By hand:			
By hand (extra).....	.02	Narrow tool.....	.12		
BRUSHING.		Broad tool (extra).....	.04		
Brushing heels, not padded.....	.02	By machine.....	.07		
If faked by hand (extra).....	.006				
Operations.	Standard machine without wheel.	Rotary machine without wheel.	Operations.	Standard machine without wheel.	Rotary machine without wheel.
EDGE SETTING.¹			EDGE SETTING—contd.		
Mock welts, single soles only.....	<i>Per dozen.</i> \$0.11	<i>Per dozen.</i> \$0.09	Painting edges by setter for colored work with camel's-hair brush.....	<i>Per dozen.</i> \$0.02	<i>Per dozen.</i>
All welts.....	1.12	1.09	Ordinary black stunted bevels.....	.17	\$0.15
If burr of edge taken off by edge setters or others by drag or plow (extra).....	.02		Black bevel work:		
Reduction for once setting mock welts with quick edge ink.....	.015		Fair stitched.....	.19	.17
Setting in water before setting in ink (extra)....	.03		Wetted.....	.19	.17
Setting in water before setting in color (extra)...	.03		Red bevel work:		
Black wetted goods.....	.15	.13	Ordinary.....	.22	.20
Black fair-stitched goods..	.15	.13	Fair stitched.....	.24	.22
Color on lips for fair-stitched or wetted goods (extra).....	.02		Wetted.....	.24	.22
			Heel ball used in setting edge (extra).....	.01	

¹ Twice setting foreparts and waists together of all goods that have black welts; ordinary work, by which is meant machine-sewn and riveted work. Edges to be colored and faked by workmen.

² On standard machine with wheel, 2 cents more per dozen.

³ On rotary machine with wheel, 10.5 cents.

⁴ On rotary machine with wheel, 11 cents.

Operations.	Rate.	Operations.	Rate.
STITCH WHEELING.		NAUMKEAG.	
By hand.....	<i>Per dozen.</i> \$0.05	Fine scouring bottoms, waists, and toppieces.....	<i>Per dozen.</i> \$0.025
Foreparts only, by machine.....	.025	Scouring front of heels (extra).....	.01
Ordinary work:		INKING OR QUICK RUSSET (NOT OAKALINE).	
Half-wide welts, by hand (extra)...	.02	Bottoms (one color to heel), black or brown.....	.02
Half-wide welts, by machine (extra).....	.01	Foreparts, black or brown.....	.015
Imitation of fair stitch, by hand....	.02	Waists.....	.01
BOTTOM SCOURING.		Toppieces.....	.005
Rough scouring bottoms and toppieces with roller.....	.015	PADDING AND BRUSHING, QUICK BLACK OR RUSSET.	
Brushing dust out of welts by machine after scouring.....	.006	Bottoms (one color to heel):	
Brushing dust off bottoms, as a separate operation by hand.....	.01	Black.....	.035
Tips on heels (extra).....	.02	Russet.....	.03
Slugged bottoms (extra).....	.03	Foreparts.....	.025
By hand, after machine:		Waists.....	.02
Foreparts.....	.02	If faked by hand (extra).....	.01
Waists.....	.02	Toppieces (including faking by hand)...	.01
Buffing bottoms by hand:		Digging front of heels and filling holes	.025
Foreparts.....	.02		
Waists.....	.02		

Finishing in conjunction with machinery—Continued.

WOMEN'S ORDINARY—Continued.

Operations.	Rate.	Operations.	Rate.
PADDING AND BRUSHING, QUICK BLACK OR RUSSET—continued.	<i>Per dozen.</i>	INKING.	<i>Per dozen.</i>
Burnishing black bottoms with ordinary ink, by hand:		Strips, round or square.....	\$0.68
Foreparts.....	\$0.06	Strips, peaked.....	.05
Waists.....	.07	Strips, waist iron.....	.01
Toppieces.....	.08		
All through.....	.16	BURNISHING.	
Burnishing quick black, russet, or chocolate, by hand:		Marked out strips, round or square:	
Foreparts.....	.05	By hand.....	.04
Waists.....	.05	By machine.....	.025
Toppieces.....	.02	Peaked strips, by hand.....	.07
All through.....	.10	Waist iron strips:	
Holding pad on white foreparts.....	.01	By hand, if black or fiddle.....	.025
		By machine.....	.015
DAMPED-DOWN BOTTOMS.		GUMMING BOTTOMS.	
Through by hand (old style).....	.03	By hand (after painting):	
Foreparts only (old style).....	.02	Foreparts only.....	.015
		Through.....	.02
PAINTING BOTTOMS.		BRUSHING BOTTOMS.	
One color, foreparts or through.....	.025	By machine (after painting):	
Two colors.....	.045	Foreparts only.....	.01
Chrysodene or inking front of heels.....	.005	Through.....	.015
Painting front of heels.....	.005	French chalking:	
Using size or acid on bottoms before painting (extra).....	.01	Foreparts (extra).....	.01
Filling holes in sole, by painter.....	.01	Waists (extra).....	.01
Filling channels with paint.....	.01		
Painting toppieces:		FAKING BY HAND AND POLISHING BY MACHINE.	
If same color as waist or bottom.....	.005	Fiddle waists (painted).....	.065
If different color.....	.01		
Buffing across top of waist (after padding).....	.015	MAKING GUMMED FIDDLES, NOT OAKALINE OR PAINT.	
CLEANING RIVETS.		Scraping fronts and cutting corners.....	.025
Oakaline work:		Marking across waist.....	.015
Foreparts.....	.015	Gumming fiddle waist, front of heel, and toppiece.....	.06
Waists.....	.015	Gumming fiddle bottoms, heel to heel, front to heel, and toppiece.....	.06
Toppieces only.....	.01	Marking strips.....	.03
Black bottoms:		Dull knifing fiddles.....	.015
Foreparts.....	.02	Faking fiddle waist:	
Waists.....	.02	With polishing by machine.....	.08
Toppieces.....	.01	With polishing by hand.....	.12
MARKING.		Faking fiddle bottoms:	
Marking waists across with dull knife once (before painting).....	1.16	With polishing by machine.....	.12
Marking out strips (after painting):		With polishing by hand.....	.16
Round or square.....	.03	CLEANING OFF PAINT BY WET RAG OR DULL KNIFE AND PUTTING ON COLOR FOR TOP IRONING.	
Peaked.....	.06	Foreparts, by hand.....	.02
Cleaning strips by wet rag or dull knife for inking (after painting):		All round.....	.025
Round or square.....	.02	If buffed or sand-sticked (extra).....	.02
If buffed (extra).....	.02		
Peaked.....	.04	TOP IRONING.	
If buffed (extra).....	.02	By hand:	
Cleaning waist iron strips by wet rag or dull knife (after painting).....	.01	Foreparts.....	.04
If buffed (extra).....	.015	All round.....	.07
MARKING OUT FOR BORDERING.		By self-feeding machine:	
Heel to heel.....	.045	Foreparts.....	.02
Foreparts only.....	.025	All round.....	.025
Waists only.....	.025	Heel-balling edge of sole by hand before top ironing.....	.01
PAINTING BORDERED WORK OR BROWN CENTERS.		Bevels, other than black work.....	.06
Heel to heel.....	.07	Black bevels, by hand.....	.04
Foreparts only.....	.05	IMITATION BUNKING ON OAKALINE.	
Waists only.....	.04	By hand:	
		Foreparts.....	.04
		Waists.....	.025
		All round.....	.06

1 Per gross.

Finishing in conjunction with machinery—Continued.

WOMEN'S ORDINARY—Continued.

Operations.	Rate.	Operations.	Rate.
IMITATION BUNKING ON OAKALINE—continued.		GETTING OFF—continued.	
By machine:	<i>Per dozen.</i>	Rubbing up and pollishing, etc., with-out machine (2 cloths).....	<i>Per dozen.</i> \$0.06
Foreparts.....	\$0.025	Foreparts only.....	.03
Waists.....	.015	Waists only.....	.03
All round.....	.04	Toppieces only.....	.01
BUNKING ON BOTTOMS OTHER THAN OAKALINE.		Cleaning off tops, if done in finishing room:	
By hand:		Black.....	.04
Foreparts.....	.07	Colored.....	.06
Bordered bunking.....	.08	Cleaning off ink or wax round the leather:	
Waists.....	.06	Patent vamps.....	.02
Bordered bunking.....	.06	Patent goloshes only.....	.02
All round.....	.12	Patent caps.....	.015
Bordered bunking.....	.14	Patent all round.....	.04
By machine:		Cleaning ink:	
Foreparts.....	.03	Edges of heel tips.....	.02
Waists.....	.02	Half-heel tips.....	.015
All round.....	.045	Quarter-heel tips.....	.01
PUTTING COLOR ON.		Toe tips.....	.015
Bevels, other than black work.....	.04	Cutting and drawing string before slipping lasts.....	.01
Buffing paint off bevels.....	.02	Unbuttoning before slipping lasts (not more than 4 buttons).....	.01
Sandpapering bevels ready for coloring.....	.02	Slipping lasts and pairing up in sizes only.....	.01
Coloring black bevels.....	.02	Loose blocks (extra).....	.01
GETTING OFF.		Boning:	
Cleaning paint off front of heels.....	.01	Bottoms through.....	.05
Clearing fronts of toppieces only.....	.01	Foreparts.....	.025
Gumming front of heels.....	.01	Waists.....	.03
Polishing front of heels.....	.015	Toppieces.....	.015
Filling up holes:		Fronds of heels.....	.015
In inferior chunk heels.....	.02	Brushing bottoms by hand:	
In front of heels with paste.....	.01	Foreparts.....	.015
In heels if very bad, sectional (extra).....	.02	Waists.....	.015
Filling defective channels.....	.03	Toppieces.....	.005
Renovating strips (touching up strip with hot dull knife and faking sides).....	.02	Heel ironing toppieces on ordinary work.....	.02
Heel ironing toppieces on ordinary work.....	.02	LOUIS HEEL WORK (WOOD HEELS) NOT COVERED.	
Cleaning paint off edges.....	.015	Trimming:	
Crowing once across waists (fancy crowing extra).....	.015	Lifts and toppieces—	
Cutting down corners of heels (to be paid to painter or getter-off).....	.02	By hand.....	.05
Quick blacking by hand second time (after padding), and pollishing by brush or ball rag:		By machine.....	.02
Foreparts.....	.025	Corners of heels, by hand.....	.03
Waists.....	.02	Sandpapering, by hand.....	.08
Heels.....	.02	Heel scouring, rough and fine, by machine.....	.035
Faking edges.....	.01	Heel padding and seat wheeling, by machine.....	.03
Polishing bevels.....	.02	Buffing and sandpapering front of heels and leveling toppieces, by hand.....	.08
Polishing and brushing heels and edges by machine.....	.02	Crowing under toppieces, by hand.....	.02
Polishing heels and edges by hand after machine (polishing cloth only).....	.03	Crowing sides of heels, by hand.....	.02
Rubbing up and pollishing heels and edges by hand:		Cleaning inserted plates, by hand.....	.03
After machine (2 cloths).....	.045	Faking and pollishing front of heels and waists by machine:	
Without machine (2 cloths).....	.06	Stain or quick russet.....	.025
Polishing painted foreparts, waists, and toppieces together by hand after machine (polishing cloth only).....	.03	Stain or quick russet with toppieces.....	.03
Foreparts only.....	.015	Getting off (heels to be inked and brushed twice by hand, sides of heels to be made good, and burnished, faked, and polished off).....	.16
Waists only.....	.015	LOUIS HEEL WORK, LEATHER COVERED.	
Toppieces only.....	.005	Heel scouring rough and fine, by machine.....	.045
Rubbing up and pollishing (as above) 2 cloths.....	.045	Padding and seat wheeling, by machine.....	.06
Foreparts only.....	.02		
Waists only.....	.02		
Toppieces only.....	.01		

Finishing in conjunction with machinery—Continued.

WOMEN'S ORDINARY—Continued.

Operations.	Rate.	Operations.	Rate.
LOUIS HEEL WORK, LEATHER COVERED—continued.		LOUIS HEEL WORK, LEATHER COVERED—continued.	
Setting toppieces, by machine.....	<i>Per dozen.</i> \$0.025	Top ironing:	<i>Per dozen.</i>
Naumkeaging foreparts, waists, and front of heels.....	.03	All round toppieces	
Painting front of heels, waists, and toppieces, by hand.....	.03	By hand.....	\$0.025
Brushing, faking, and polishing waists and toppieces, by hand.....	.03	By machine.....	.015
		Front of toppieces, by hand.....	.01
		Back of toppieces, by hand.....	.02
		Polishing by cloth after machine, edges and heels only.....	.05

WOMEN'S TURNS.

Operations.	Rate.
EDGE PARING.	
By hand.....	<i>Per dozen.</i> \$0.02
By machine.....	.025
EDGE SETTING.	
By hand.....	.06
By machine.....	.07

NOTE.—Edges to be inked by workmen; sew-round work not faked.

CANVAS WORK, MEN'S, WOMEN'S, BOYS', AND GIRLS'.

Operations.	Rate.	Operations.	Rate.
	<i>Per dozen.</i>		<i>Per dozen.</i>
Putting in lasts.....	\$0.005	Inking toppieces.....	\$0.005
Heel paring and randing.....	1.38	Padding black toppieces.....	.01
Plowing out, all round.....	1.32	Gumming bottoms.....	.015
Forepart paring and waists.....	1.38	Painting through, one color.....	.02
Heel scouring, rough and fine (heels not over 1½ inches high).....	1.26	Brushing bottoms, by machine.....	.005
Coloring heels, any color.....	.005	Top ironing, all round.....	.01
Padding and brushing heels and seat wheeling.....	1.20	Imitation bunking, all round on oaks-line:	
Cutting down corners of heels and paring up.....	1.085	By hand.....	.06
Edge setting and stitch wheeling:		By machine.....	.04
Rotary machine with wheel.....	.065	Getting off by hand, cleaning paint off front of heels, polishing up heels and edges with rag by hand, and slipping lasts.....	.035
Rotary machine without wheel.....	.055	Cleaning paint off front of heels.....	.01
Welts (extra).....	.02	Rubbing off edges and heels by machine.....	.01
NOTE.—Edges to be colored by workmen.		Polishing edges and heels by hand after machine and slipping lasts.....	.01
Scouring bottoms and toppieces.....	1.08	Slipping lasts with loose blocks (extra).....	.005
Naumkeaging:		Tying up by machine.....	.01
Fine scouring bottoms, waists, and toppieces.....	1.12	Polishing after white bottoms (extra).....	
Fine scouring waists and toppieces.....	1.08		
Staining natural bottoms.....	.005		

¹ Per gross.

*Finishing in conjunction with machinery—Continued.*NURSERY WORK, RIVETED AND MACHINE SEWN.¹

Operations.	Rate.	Operations.	Rate.
	<i>Per dozen.</i>		<i>Per dozen.</i>
Putting in lasts, by hand.....	\$0.08	Painting or staining:	
Plowing out, heel to heel, by hand.....	.015	One color.....	\$0.02
Plowing out seat, by hand (extra).....	.005	Two colors.....	.025
Paring heels only:		Black or colored toppieces (extra).....	.005
By hand.....	.02	Padding black toppieces.....	.005
By machine.....	.015	Cleaning rivets:	
Paring all round, including heels, and taking out seats:		Foreparts and waists.....	.02
By hand.....	.045	Toppieces.....	.01
By machine.....	.035	Faking bottoms and toppieces.....	.01
Paring foreparts and waists:		Gumming bottoms and toppieces.....	.01
By hand.....	.025	Brushing bottoms and toppieces.....	.005
By machine.....	.02	Top ironing:	
Cutting off heel fronts.....	.015	Heel to heel, by self-feeding machine.....	.01
Heel and edge setting operations combined:		Heel to heel, and putting on color, by hand.....	.025
With stitch wheel and seat wheel, one machine.....	.08	All round, including toppieces, by machine.....	.015
Without stitch wheel or seat wheel.	.065	All round, including toppieces, and putting on color, by hand.....	.03
NOTE.—Edges to be colored by workmen.		Cleaning fake and ink off patent.....	.015
Stitch wheeling, forepart only, by hand.....	.02	Crowing across.....	.01
Seat wheeling, by machine.....	.005	Getting off, polishing edges and heels by hand, and slipping lasts.....	.025
Scouring bottoms and toppieces.....	.01	Tying up:	
Naumkeaging bottoms and toppieces.....	.015	By hand.....	.01
Marking across with dull knife.....	.005	By machine.....	.005

¹ Definition: A boot or shoe with a single sole, one lift and topiece; the sizes half a size less than 4 to 6 work, and the range 2's to 6's.

² Per gross.

MEN'S TURNS.

Count as women's ordinary work. Single peaked strips 12 cents per dozen.

WOMEN'S CASHMERE AND WARD SHOES.

Fifteen pairs count as 1 dozen of women's ordinary work. For heels over three-fourths inch and up to 1½ inches high, one-half cent extra per dozen to parer, scourer, and padder. Definition of ward shoe: One bar or spring front, leather or rubber toppiece.

WOMEN'S FELT BOOTS.

Buttons and bals, 15 pairs to count as 1 dozen of women's ordinary work.

GIRLS' WORK AND SANDALS.

Best class.—Sizes 7 to 10, 15 pairs to count as 1 dozen women's ordinary work; sizes 11 to 1, 14 pairs to count as 1 dozen women's ordinary work.

Common class.—Sizes 7 to 10, 16 pairs to count as 1 dozen women's ordinary work; sizes 11 to 1, 15 pairs to count as 1 dozen of women's ordinary work.

BOYS' WORK.

Sizes 2 to 5, 10 pairs to count as 1 dozen of women's ordinary work; sizes 7 to 10, 14 pairs to count as 1 dozen of women's ordinary work; sizes 11 to 1, 12 pairs to count as 1 dozen of women's ordinary work.

CHILDREN'S WORK AND SANDALS (4's to 6's).

Best class.—Sixteen pairs to count as 1 dozen of women's ordinary work.

Common class.—Eighteen pairs to count as 1 dozen of women's ordinary work.

WEEKLY WAGE COST AND OUTPUT.

In most English shoe factories the weekly wage system prevails, the rate paid per week being based for each operator upon the foregoing prices for the various operations. The following table shows an actual weekly wage cost and the amount of work accomplished, and it may be taken as a fair average:

Operations.	Average amount of work accomplished.	Weekly wages.
Cutting.....	3½ dozen men's or 3 dozen women's, per day.....	\$7.77-\$8.50
Cutting lining, and trimming:		
Youth.....		
Boy.....	300 dozen per week.....	4.86
Skiving (Marvel skiver).....	300 dozen women's or 350 dozen men's, per week.....	3.88
Folding.....	100 dozen per week.....	3.40-3.88
Closing.....		3.88
Turning and beading.....		3.40
Top stitching.....	100 dozen per week.....	3.88-4.37
Vamping.....	10 dozen whole vamps or 15 to 18 circular vamps per day.....	88-4.37
Lining making.....	100 dozen per week.....	2.91
Eyeletting.....	350 dozen per week.....	2.91
Tip stitching.....	300 dozen per week.....	3.88
Punching.....		3.88
Pressing.....	300 pair per week.....	7.29
Stock fitting.....		7.29-7.77
Channeling.....	300 dozen per week.....	7.29-7.77
Heel building (average 1 to 1½ inch).....	150 dozen per week.....	4.86
Preparing for laster (boys).....	25 dozen per day.....	3.88
Pulling over (Rex).....	50 dozen per day.....	10.93
Consolidated lasting.....	20 dozen per day.....	10.93
Pounding up.....	40 dozen per day.....	7.29
Sole attaching.....	25 dozen per day.....	7.77
Getting off.....	60 dozen per day.....	7.29
McKay sewing.....	25 dozen per day.....	8.50
Leveling.....	35 dozen per day.....	7.77
Heeling.....	60 dozen per day.....	7.77
Second lasting:		
Boy.....	do.....	2.91
Man.....	do.....	6.07
Heel trimming.....	do.....	8.50
Edge trimming.....	25 dozen per day.....	7.77
Heel scouring.....	do.....	7.29
Edge setting.....	15 dozen per day.....	8.50
Heel burnishing:		
Boy.....	60 dozen per day.....	2.91
Man.....	do.....	7.29
Bottom scouring.....	do.....	7.29
Buffing.....	do.....	7.29
Bottom staining or blacking.....	do.....	7.77
Bottom padding (youths).....	30 dozen per day.....	4.37
Bottom stamping (youths).....	80 dozen per day.....	3.88
Cleaning (youths).....	30 dozen per day.....	3.88
Ironing or treeling and dressing (girls).....	15 to 20 dozen per day.....	3.88
Socking (girls).....	30 dozen per day.....	2.43
Packing.....	60 dozen per day.....	2.91
WELTED WORK.		
Upper trimming and tack pulling (boys).....	50 to 60 dozen per week.....	3.88
Weltting.....	12 to 15 dozen per day.....	9.72
Welt trimming and beating.....	20 dozen per day.....	4.86-6.07
Bottom filling (boys).....		2.91
Sole laying.....	20 dozen per day.....	7.29
Rounding.....	do.....	8.50
Channel opening (boys).....		2.91
Stitching:		
Youth.....		
Man.....	15 dozen per day.....	4.37
Leveling (Acme).....	15 to 20 dozen per day.....	7.29
Heeling.....	300 dozen on the last per week.....	8.50
Heel trimming.....		8.50
Edge trimming.....	10 to 12 dozen per week.....	8.50
Edge setting.....	do.....	8.50

MANUFACTURING COST OF GOODYEAR-WELT SHOES.

The following table shows the cost per pair of manufacturing weekly 2,500 pairs of men's Goodyear-welt shoes corresponding in grade to a \$3 shoe (factory price) in the United States:

Operations.	Cost per pair.	Operations.	Cost per pair.
Pattern cutting, skin room, cutting, and assembling.....	\$0.05	Finishing.....	\$0.08
Closing.....	.08	Packing room.....	.03
Rough stuff cutting and preparation.....	.045	Grindery (nails, tacks, thread, etc.).....	.03
Lasting and heeling.....	.085	Total.....	.465
Royalty.....	.055		

COST OF MANUFACTURING WOMEN'S SHOES.

The following table shows the cost of manufacturing women's McKay-sewn and Goodyear-welt shoes corresponding to a like grade manufactured in the United States at the value of \$1.87 per pair for McKay sewn and \$1.95 for Goodyear welt (factory price):

Operations.	Cost per dozen.	
	McKay sewn.	Goodyear welt.
Cutting outside and lining, including foreman's wages at \$8.50 per week.....	\$0.606	\$0.606
Closing room, including skiving, and including forewoman's wages at \$6.07 per week.....	0.606-.85	0.606-.85
Sole leather room, including heel building, top piecing, slugging, breasting, and scouring breast.....	.243	.243
Pulling over, \$10.94 per week for 50 dozen per day.....	.04	.04
Lasting, consolidated, 2 men at \$10.94 per week, 44 dozen per day ¹	.0892	.0892
Laying soles, including nailing heel seats, McKay work, 1 man at \$4.86 and 1 man at \$7.29 per week, 50 dozen per day.....	.043	
Sewing, McKay work, 1 man at \$9.72 per week, 40 dozen per day.....	.043	
Sewing, Goodyear work, 1 man at \$10.20 per week, 20 dozen per day.....		.0916
Trimming seams and beating welt at \$3.58 per week, 20 dozen per day.....		.0348
Bottom filling, tacking in shank, cementing bottom, cementing sole, \$4.86 per week, 20 dozen per day.....		.0436
Sole laying by machine (Goodyear), \$7.29 per week, 20 dozen per day.....		.0654
Rough rounding, \$9.72 per week, 20 dozen per day.....		.0872
Opening channels, boy at \$2.91 per week, 20 dozen per day ²		.026
Stitching, \$8.50 per week, 20 dozen per day.....		.0762
Leveling, \$7.78 per week, 20 dozen per day.....	.0464	
Leveling, \$4.37 per week, 20 dozen per day.....		.04
Heeling, \$7.29 per week, 50 dozen per day.....	.026	.026
Relasting, \$2.91 per week, 60 dozen per day.....	.0086	.0086
Heel lining, including sock lining.....	.015	
Heel shaving.....	.04	.04
Heel scouring, 2 men at \$7.29 per week each, 60 dozen per day.....	.0436	.0436
Edge trimming.....	.05-.06	.05-.06
Stitch separating, \$2.91 per week, 20 dozen per day.....		.026
Edge setting, \$8.50 per week, 15 dozen per day.....	.10	.10
Buffing, Naumkeag, brushing the edge and the stitch, 1 man at \$4.86, 1 man at \$7.29, 60 dozen per day.....	.0362	.0362
Hand finishing, including painting bottom, blacking shank and toppieces, \$8.50 per week, 60 dozen per day.....	.0254	.0254
Boy to ink, \$2.43 per week, 60 dozen per day.....	.007	.007
Heel burnishing, Xpedite, \$7.29 per week, 60 dozen per day.....	.0218	.0218
Ironing and dressing.....	.06	.06
Packing, including daywork and foreman.....	.02	.02

¹ The other 6 dozen are done by the McKay sole sewer at \$9.72 per week.

² This boy puts in half his time on other work.

COST OF FITTING AND MACHINING WOMEN'S BOOTS AND SHOES.

The following table shows the cost of fitting and machining women's boots and shoes, \$2.25 grade (factory price):

[illegible]

¹ Per gross.

* Per thousand.

³ All button bits closed on before bagging on, including top stitch.

⁴ Per row.

* Per row.
• Per dozen lots.

In general, English operatives are not so energetic as the American and in an equal time will not perform the same amount of work.

MINIMUM WAGE SCALES—RENTS—CHILD LABOR.

Each shoe center has a scale of wages for all the factories which is agreed upon by the trades union and the manufacturers' associations, a minimum wage being fixed for each male adult employee. The minimum wage paid in Leicester and Bristol is 30s. (\$7.29) per week and in Northampton 29s. (\$7.05), the scale averaging practically the same throughout the country. The average shoe workman receives a wage ranging from 29s. to 35s. per week (\$7.05 to \$8.51).

Rents are paid weekly. A house of four rooms may be rented for as low as 3s. 6d. (85 cents); for 6s. (\$1.46) a house of six rooms may be obtained. As regards workmen's dwellings, recent returns show the following for Leicester and suburbs:

Houses let at weekly rate of—	Number.
5s. (\$1.21).....	16,922
5s. 3d. (\$1.27).....	592
5s. 6d. (\$1.33).....	3,615
5s. 9d. (\$1.39).....	792
6s. (\$1.46).....	7,892

Tram or electric car fares are low, the average journey being 2.18 miles per penny (2 cents).

The standard of living is lower than that obtaining in the United States. Labor troubles during the past few years have been very infrequent. Disputes go to arbitration according to terms of settlement, which render a strike or lockout virtually impossible. As regards employment of the sexes, the factories are organized the same as in the United States, female operatives being practically limited to the stitching and packing rooms; only in very rare instances do they fill other positions.

As regards the employment of children, no employer is allowed to engage any child under 14 years of age, and all children under 16 years obtaining employment in shoe factories are obliged to pass a medical examination. The employer is compelled by law to notify the medical examiner (appointed by the Government) immediately upon employing the child. The cost of such examination is 2s. 6d. (60 cents), paid by the employer. About the same percentage of child labor is found in the English as in the American shoe factories, and they fill like positions.

LABOR CONDITIONS IN LEEDS DISTRICT.

Leeds city proper is noted for heavy work of a rather higher grade than that done in other districts. The following details apply particularly to the class of work and conditions of labor in Leeds.

A pressman or operator on a dieing-out machine earns from 28s. to 30s. (\$6.81 to \$7.29) per week. The soles and half soles are cut by the operator, while the waist pieces, shank pieces, etc., are cut by a youth at a wage of 10s. to 12s. (\$2.43 to \$2.92) per week.

The soles, half soles, shank pieces, and waist pieces are tacked together and molded by boys or girls in a fitting-up room supervised

by a foreman. The foreman's wages are about £2 (\$9.73), while the girl or boy employed in preparatory work of the bottoms earns from 5s. to 10s. (\$1.21 to \$2.43), according to age, per week. The work accomplished by each employee varies considerably, dependent on the class of work and whether a boot requires two long soles or half soles and is built up with waist and shank pieces. If the former, a boy or girl will tack together about 40 dozen pairs per day, and if the latter from 20 to 30 dozen pairs.

Regarding lasting, one pulling-over machine will pull over for two and one-half consolidated lasting machines. Where a pulling-over machine is serving two consolidated lasters, the average wage is about 30s. (\$7.29) per week.

Operators on consolidated lasting machines are paid £2 to £2 2s. (\$9.73 to \$10.22) per week for 1,000 pairs, the quantity fluctuating, however, from 1,000 to 1,400 pairs, according to the character of the work. On the heavy navy work 1,000 pairs a week is a good week's work for the wage quoted. A man on the Rex rotary beating-up machine earns 28s. to 30s. (\$6.81 to \$7.29), per week and will beat up, if necessary, for three consolidated lasters on the Leeds heavy type of work. The sole tacker on handles 30 to 40 dozen pairs per day for a wage of 28s. to 30s. (\$6.81 to \$7.29) per week. An operator on a Standard screw machine does about 50 dozen pairs a day for a wage of 35s. (\$8.50) per week.

McKay operators accomplish from 40 to 50 dozen pairs in a day and receive from 30s. to 35s. (\$7.29 to \$8.51) for a week's work. On the stitcher an operator does about the same quantity and receives the same wage as a McKay operator. Those employed at nailing surface nails by machine, such as round tacks, star hobs, bullet hobs, and ray hobs, nail from 20 to 25 dozen pairs per day, earning 30s. to 35s. (\$7.29 to \$8.51) per week.

Boots of a "drive up" character, having what is known as a Cutlan nail (a taper-headed nail), are done at the rate of 25 to 30 dozen pairs a day for a wage of 32s. to 35s. (\$7.78 to \$8.51) a week.

A man on the Hercules leveler turns off 800 to 1,000 pairs a day, with the assistance of a boy, and earns 30s. to 35s. (\$7.29 to \$8.51) per week. Round-headed nails are put in by machine, rectangular or irregular shaped nails by the man at the bench. Many boots are manufactured for British trade in the country and agricultural districts and for workers in foundries, rolling mills, and mines with what is called a ridge hob, clasp hob, or a taper fitter, which nails can not be driven by machine.

As showing the advantage that machinery has given the Leeds manufacturer during the last few years in the production of his specialty, the hob-nail boot, the following cost statement gives what was previously paid per dozen pairs for hand labor and what is now paid for work by machine:

Items.	Hand-work.	Machine work.
Material.....	Cents. 16.5	Cents. 22.5
Labor.....	30	6
Expenses, supervision, light, power, etc.....	8	8
Depreciation of machinery.....		2
Total.....	54.5	38.5

MANCHESTER DISTRICT.

Manchester's shoe-manufacturing industries and those of its outlying sections are largely devoted to the production of canvas goods and slippers. The latter are manufactured from a variety of materials and in a variety of ways; some are made by the ordinary McKay method, some by hand and turned, making a turned felt, which in some instances has a light sole attached either by solutioning or running two grooves around. The light leather sole, being too light to channel, is sewn with a lock-stitch sole sewer on grooves which would ordinarily be run round by the channeling machine. Other classes of this work are built with a composition sole backed with a leather fleshing, and are either riveted or McKay sewn.

Another class, generally known as house boots, is made of a hairy felt known in the trade as camel hair, with a thick felt sole sewn by hand and turned. A very cheap class of felt boots is also manufactured. These are sewn by small girls on the long-arm Bradbury sewing machine and are turned after being sewn.

The ward shoes and cheap oxfords made in the district are lasted at the rate of 35 to 40 dozen pairs per day, the lasting-machine operator being paid about £2 (\$9.73) per week. On this class of work one beating-up machine is able to handle the work of 3 consolidated lasters, and the man operating the same is paid from 30s. to 32s. (\$7.29 to \$7.78) per week.

The sole tacker tacks on about 40 dozen pairs daily for a wage of 28s. to 30s. (\$6.81 to \$7.29) per week, and the operator on the No. 3 improved Blake machine does from 70 to 80 dozen pairs daily for a wage of £2 to £2 2s. (\$9.73 to \$10.22) per week.

The operator on a Cyclops leveler levels about 1,000 pairs in a day, with the assistance of a boy closing the channels and raising the edge.

The canvas goods manufactured in the Manchester (Waterfoot) district range in price from 1s. 11½d. (47 cents) to a fair canvas boot at 4s. 6d. (\$1.09) per pair. Most of the Manchester and Waterfoot canvas goods are made with a composition insole and counter and pulp heel with a leather lift. It is only fair to state, however, that common as this work may be, it has shown great improvement in appearance in the last few years.

There is still another type of slipper made in Waterfoot which has a cheap tapestry top and a linoleum sole with one or two linoleum lifts. This line is either riveted with iron tangles or sewn with a Blake machine.

A very cheap class of slipper, sold at 7d. to 10d. (14 cents to 20 cents) per pair, is also turned out. The manufacture of these cheapest sorts is, however, gradually being discontinued, and the Waterfoot shoe manufacturers as a whole are improving their products. In some instances creditable better-class slippers, including a morocco leather bath slipper, are turned out.

The Waterfoot productions are manufactured chiefly for export trade, a large percentage going to the colonies and a considerable quantity to Scotland.

BUILDINGS—RENTS—TAXES.

Most of the buildings in England in which boot and shoe manufacturing is carried on are from three to five stories in height. There is, however, a decided tendency, where the cost of land is not prohibitive, toward building single-story factories with north-light roofs. The cost of these factories, exclusive of the cost of land but including heating apparatus and elevators, works out at approximately \$1.09 per square foot of floor space measured inside the walls of multiple-story factories, and \$1.42 per square foot in the case of single-story factories.

The cost of land varies from about 1s. (24.3 cents) per square yard in some country villages to about £1 (\$4.86) in some towns. There are not many villages where suitable sites for factories can be obtained for as low as 24.3 cents per square yard; likewise very few factories are now built upon land as costly as \$4.86. A fair approximate cost of the land would be 7s. 6d. (\$1.82) per square yard.

If a manufacturer rents his factory from the owner, he usually pays as rent about 5½ per cent per annum on the cost of the factory, including land; and the manufacturer usually undertakes to keep the factory in repair, the cost of such repairs amounting to approximately 5 per cent of the rent.

Rates¹ and taxes vary with the locality, from about one-sixth of the rent in some villages to about two-fifths of the rent in some towns; the average is between one-fourth and one-third of the rent. In most of the large shoe-manufacturing centers the rates and taxes amount to about one-third of the rent.

RELATION OF FLOOR SPACE TO OUTPUT—MOTIVE POWER.

As regards the relation of floor space to output, the following figures are stated with reserve and the writer does not vouch for their absolute accuracy, though he has been at some pains to get them as correct as possible. The floor space required for a given output varies from about 2 to 7 square feet of floor space to each pair of boots or shoes made in a week of 54 hours, the former figure when the output consists of ladies' slippers and cheap McKay-sewn shoes, and the latter figure when the product is men's high-class welted shoes (high cuts). The figures are for floor space used for manufacturing purposes, exclusive of that required for storing finished goods.

Most of the shoe factories in England are driven by gas engines, many of which use gas produced from anthracite, usually in a suction-gas plant. Where gas engines are not used, power is derived from oil engines, steam engines, or electric motors driven by gas from some public supply.

The following is an estimate of the percentage of factories driven in different ways: Gas engines driven by illuminating gas, 60 per cent; gas engines driven by producer gas, 30 per cent; oil engines, 5 per cent; steam engines, 3 per cent; electric motors, 2 per cent.

The cost per brake horsepower varies in different districts and under different circumstances. It works out approximately as follows: Gas engines driven by illuminating gas, 10 cents; gas engines driven by producer gas, 8 cents; oil engines, 10 cents; electric motors, 15 cents; steam engines, 24.3 cents.

¹ Rates correspond to local taxes in the United States. The term taxes, as used in the United Kingdom, generally applies to governmental (national) taxes.

MACHINERY EQUIPMENT—OVERHEAD CHARGES.

The following gives the cost of machinery for manufacturing 300 pairs of shoes per day in England:

Equipment.	Cost.	Equipment.	Cost.
Stitching room machines.....	\$487	Feet for treeling machine, 50 pairs.....	\$122
Cutting room machines.....	97	Shafting.....	292
Bottoming room machines.....	(¹)	Gas engine, 15 horsepower.....	730
Sole leather room machines (special fittings).....	243	Sole leather knives.....	58
Sole leather room machines.....	(²)	Shoe racks, 50.....	97
Lasts, 600 pairs.....	584	Bins, etc.....	97
Treeling machine.....	97	Total.....	2,904

¹ Rent of machines per annum, \$292.

² Rent of McKay stitcher per annum, \$73.

As regards overhead charges, a prominent Northampton manufacturer states that his overhead charges are 11 per cent of the value of the output. This does not include interest on capital. Lasts, patterns, and dies are charged off in the same way as bills for fuel.

SCOTLAND.

Boot and shoe factories in Scotland are much more scattered than in England. There are a half dozen firms in Glasgow, while in other towns from north to south there are usually no more than two firms in a town. The industry is growing, however, and I am informed that the output has trebled during the last five or six years, notwithstanding a decrease in the number of factories. The older Scotch firms who have kept their factories well up to date with improved machinery are doing exceedingly well. There is a general progressive tendency in the industry, and one finds few of the old type of conservative manufacturer.

Factory buildings are constructed along modern lines, nearly all being on the one-floor system, and they are generally as fully equipped with modern shoemaking machinery as similar factories in the United States. Practically all the equipment is supplied by the British United Shoe Machinery Co. As regards the introduction of American machinery, the first Goodyear welt sewer and stitcher used was installed by Allan Bros., Edinburgh, in 1889, which was likewise the first used in the British Isles. The American Standard screw machine had been adopted some five or six years earlier. The firm mentioned has to-day a thoroughly up-to-date plant, although its trade is a comparatively small "bespoke" business.

Previous to the introduction of American machinery the industry in Scotland was almost entirely of a bespoke nature, practically no effort being made by manufacturers to extend business outside their own localities.

Only one firm in Scotland has a specialized output, this being the Saxone Shoe Co., of Kilmarnock, which makes men's high-class welted goods only. McKay-sewn, Standard-screwed, and riveted footwear for both sexes and all ages constitutes the output of most Scotch factories; certain establishments produce a small proportion of welted work; no turned shoes are made.

The production of welted goods is increasing, as this type of shoe is growing in favor with the trade. Footwear is built almost exclusively on American-shaped lasts and principally of the following leathers: Box calf, which is very popular for both men's and women's goods; willow calf and glazed kid. Heavy kips are used in miners' and navvies' boots.

WAGES AND PRODUCTION—COST OF LIVING.

A standard wage prevails for the different operations, which varies according to the district in which the factory is located. In the larger cities where the cost of living is greater a higher wage obtains than in provincial sections. Of the labor employed from 75 to 85 per cent is male. The weekly wage system is in vogue, 54 hours constituting a week's work. Following are the weekly wages paid in Glasgow factories for the various operations:

Operations.	Weekly wages.	Weekly production, in pairs.
Pulling-over machine.....	\$10. 93	¹ 3,000 ² 2,000
Consolidated lasting machine.....	10. 93	¹ 1,500 ² 1,000
Welting.....	9. 72	2,500
Stitching.....	8. 50	¹ 1,800
Rounding.....	9. 72	1,600
Seam paring.....	8. 50	2,000
Sole laying.....	6. 07	2,000
Leveling.....	4. 87	3,500
McKay sewing.....	8. 50	1,800
Standard screw machine.....	8. 02	1,500
Heel slugging.....	8. 02	6,000
Lightning heeler.....	9. 23	6,000
Heel trimming.....	8. 02	4,000
Edge trimming.....	9. 23	1,400
Edge setting.....	9. 23	800
Heel building.....	2. 43	1,500

¹ McKay sewn.

² Best quality.

³ Welted.

⁴ Welted work.

Managers are paid \$24 to \$32 per week, and foremen of departments \$12 to \$15. For provincial towns, approximately 20 per cent may be deducted from the foregoing scale.

The system in Scotch factories is generally not so complete in detail as in the United States and there is an almost entire absence of specialization. Considering these conditions it would seem that the efficiency of labor ranks fairly well.

It is estimated that in most Scotch towns rent and living expenses average about 25 per cent more than in English provincial centers, such as Leicester, for which figures have already been given, and 15 per cent more than in London.

IRELAND.

There are about a dozen boot and shoe factories in Ireland, the combined output of which is 10,000 to 12,000 pairs per week. The largest factory is in Cork, its output being 3,500 to 4,000 pairs per week. The weekly output of other firms ranges from 100 to 3,000 pairs.

The demand for Irish-made boots and shoes increases each year, it is said, and the output is gradually growing. Only five factory buildings in the country are at all modern; many of the remainder are hardly fitted for shoe manufacturing. Progress is certainly being made, but it is slow, which is partly due to the spirit of conservatism among the manufacturers.

Modern shoemaking machinery was introduced into Ireland about eight years ago, previous to which time bootmaking was carried on by hand. It is stated that in former times hand bootmaking was an industry of considerable importance, which was also true of the tanning industry. A certain amount of tanned leather was exported and boots and shoes of Irish manufacture were shipped in considerable quantities, while most of the home demand for both commodities was also supplied by domestic manufactures. A decline in the country's population, improvement in the methods of tanning, and the introduction of shoemaking machinery have brought about radical changes in both industries. There are now only five sole-leather tanneries in Ireland, and little upper leather is produced in the country; the handmade boot and shoe industry is hardly above the cobbling shop status.

While all the factories named in the list (p. 77) are equipped with machinery, not all have up-to-date machines. In factories of modern construction in which the latest equipment is installed the one-floor plan has been adopted. The British United Shoe Machinery Co. equipment is the only machinery used. In the smaller factories certain operations are still done by hand; no work, however, is given out to home workers.

NATURE OF OUTPUT—WAGES.

The products of Irish factories consist principally of the heavier sorts of footwear—screwed, nailed, and pegged—with a certain amount of McKay-sewn goods and a limited quantity of welted work. No turned shoes are made.

English bellies and bends and American sides are used for bottom leathers, also Irish sole leather. The latter, being of long tan-age and good quality, makes a very satisfactory bottom leather for the climatic requirements of the country. Upper stocks employed are kip, splits, box calf, and glazed kid for men's lines, and splits, satin calf, box calf, and glazed kid for women's goods. As a whole, boots and shoes are made heavier than in the United States. The domestic product finds sale largely among the laboring classes and rural population, and it must be substantial to meet the needs of the buyer. For the lighter goods—McKay and welted—American-shaped last are used.

The hours of labor in Irish factories are from 8 a. m. to 7 p. m., with an hour off for dinner. About 75 per cent of the employees are men. The Irish operator turns out much less work in a given time than the American, for which fact the absence of specialization accounts to a certain degree. Naturally, an operative obliged to turn his hand to many varieties of work does not become so proficient as the specialized workman.

The following weekly wage list may be taken as an average for the Irish boot and shoe industry:

Operatives.	Weekly wages.	Operatives.	Weekly wages.
Hand cutters and operators on clicking machines.....	\$6.30-\$6.80	Operators on consolidated lasting machine.....	\$3.50
Upper stitchers (women and girls)....	1.95- 3.40	Welters.....	\$7.30- 8.50
Rough stuff cutters, sorters, and fitters up in bottom stock room.....	3.65- 6.80	Goodyear stitchers.....	7.30
Operators on Rex pull-over machine...	7.30- 8.50	Sole rounders.....	7.30
		Other operatives.....	6.30- 6.80

The best and shoe operatives in Dublin must pay about 20 per cent more for rent than most English operatives; in other Irish towns rents are about 10 per cent higher than in most English districts. The cost of living is about the same in the two countries.

TANNING INDUSTRY.

HEAVY LEATHER.

The leather tanners of the United Kingdom may be divided into three classes—tanners of sole leather, tanners of harness leather and leather for dressing hides and splits, and tanners of sheep, goat, and calf skins.

There are in the United Kingdom about 260 sole and hide tanners, the majority of which are in England; the number of sole and hide tanners in Scotland is slightly less than in England and the tanneries are smaller. There are only 5 sole-leather tanners in Ireland. The names and addresses of the principal firms tanning heavy leathers in the various districts of England, also in Scotland and Ireland, together with a description of the trade of each will be found on pages 79 and 80.

OUTPUT OF TANNERIES.

The output of tanning and dressing establishments, as given in the 1907 census of production, follows. The returns, however, are in excess of the output of the trade as a whole, owing to the fact that leather tanned in one tannery is often sold to another to be dressed, varnished, etc., and in most cases separate returns in respect to such lots were not furnished.

QUANTITY.

Nature of output.		England and Wales.	Scotland.	Ireland.	United Kingdom.
Leather, undressed, including tanned hides or skins.....	hundredweight..	1,542,000	110,000	5,000	1,657,000
	square feet.....	7,735,000	153,000	.....	7,888,000
	dozen.....	487,000	18,000	.....	505,000
Leather, dressed, including hides tawed, curried, or otherwise dressed (except varnished) and curried or tawed skins.....	hundredweight..	330,000	35,000	5,000	360,000
	square feet.....	47,491,000	395,000	32,000	45,889,000
	dozen.....	1,313,000	8,000	.....	1,313,000
Leather, varnished, japanned, or enameled.....	hundredweight..	( )	( )	.....	10,000
	square feet.....	( )	( )	.....	2,329,000
	dozen.....	( )	( )	.....	8,000
Hair.....	pounds.....	25,486,000	3,094,000	.....	28,563,000
Wool.....	do.....	6,272,000	4,774,000	.....	11,046,000
Leather belting.....	hundredweight..	70,000	32,000	.....	102,000

VALUE.

Leather, undressed, including tanned hides or skins.....	hundredweight..	\$34,951,203	\$3,820,202	\$165,461	\$38,936,866
	square feet.....	992,766	38,932	.....	1,031,698
	dozen.....	2,613,310	253,058	.....	2,860,368
Leather, dressed, including hides tawed, curried, or otherwise dressed (except varnished) and curried or tawed skins.....	hundredweight..	12,959,489	1,294,489	100,594	13,977,000
	square feet.....	7,100,223	87,597	4,800	5,081,704
	dozen.....	6,852,032	43,798	.....	6,837,432
Leather, varnished, japanned, or enameled.....	hundredweight..	( )	( )	.....	817,572
	square feet.....	( )	( )	.....	510,962
	dozen.....	( )	( )	.....	58,398
Hair.....	pounds.....	330,922	476,917	.....	807,839
Wool.....	do.....	1,343,154	1,294,489	.....	2,637,643
Leather belting.....	hundredweight..	3,883,467	1,596,212	.....	5,479,679
Machinery accessories of leather.....	.....	764,040	24,332	.....	788,372
Hides and skins, pickled, etc.....	.....	330,922	442,851	.....	773,773
Waste products.....	.....	1,708,141	82,730	14,599	1,805,470
Other products.....	.....	905,189	4,866	.....	910,035
Work done for the trade.....	.....	841,904	29,199	.....	871,103
Total.....	.....	75,576,742	9,489,672	345,520	85,411,934

¹ To avoid the possible disclosure of particulars relating to certain firms, returns as to the output of "Leather, varnished, etc.," in England and Wales are combined with those for "Leather, dressed." Separate returns, however, are given for the United Kingdom as a whole.

RELATION OF COST OF PRODUCTION TO VALUE OF OUTPUT.

In the following table the cost of materials and amount paid to other firms for work given out to them are shown in relation to the value of the output:

	England and Wales.	Scotland.	Ireland.	United Kingdom.
Cost of materials used	\$60,286,202	\$6,998,027	\$223,859	\$67,508,088
Amount paid to other firms for work	267,657	14,599	.....	282,256
Total	60,553,859	7,012,626	223,859	67,790,344
Value of output	75,576,742	9,489,672	345,520	85,411,935
Value of output, less cost of materials used and amount paid to other firms for work	15,022,883	2,477,046	121,661	17,621,591

The actual cost of materials used in leather tanning and dressing establishments is not obtainable, for the reason that in the census of production the total of the sums returned as "materials" includes, like the total of the sums returned as "output," leather tanned by one tannery and sold to another for dressing, etc. The values must therefore be taken as approximate but in excess of the actual cost.

The quantity and value of the output of individual establishments are carefully guarded, as shown by the note following the table giving the output of the tanneries.

EMPLOYEES.

The number of persons employed in the tanning and dressing of leather, according to the census of 1907, was as follows:

Employees.	Males.	Females.	Total.
England and Wales:			
Wage earners	21,761	1,018	22,779
Salaried persons	1,751	122	1,873
Total	23,512	1,140	24,652
Scotland:			
Wage earners	2,194	38	2,232
Salaried persons	165	16	181
Total	2,359	54	2,413
Ireland:			
Wage earners	170	1	171
Salaried persons	21	1	22
Total	191	2	193
United Kingdom:			
Wage earners	24,125	1,057	25,182
Salaried persons	1,937	139	2,076
Grand total	26,062	1,196	27,258

LEADING TANNERIES—COST OF HIDES.

The proportion of small tanneries is much greater in Great Britain than in the United States, and the individual output is generally smaller. Among the most important tanneries in England may be mentioned the Highfield Tanning Co., Runcorn; Penketh Tannery, near Warrington; Messrs. Hodgsons, Beverly; T. Holmes & Sons, Hull; Harold Nicholls, Leeds; and J. J. Williamson & Sons, Canter-

bury. The Millar Tanning Co., Maybole, Scotland, is perhaps the most important Scotch establishment.

These are the largest tanneries in Great Britain. Each has an output of at least 2,000 hides per week, and three have a capacity of 3,000 to 3,500 hides. All are tanners of sole leather, and in two or three instances also do dressing and split hides and buffalo hides.

The cost of the raw material (hides), it is stated, is ordinarily about the same as in the United States; exceptions to this are English tanners who as small buyers fail to obtain the advantages which American tanners enjoy by large purchases of cargoes and shipments.

IMPORTS OF HIDES.

The following statement shows the imports of wet and dry raw hides and pieces thereof into the United Kingdom in 1908, 1909, and 1910:

Countries.	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
WET HIDES.						
Italy.....	<i>Cwt.</i> 121,065	<i>Cwt.</i> 132,952	<i>Cwt.</i> 128,750	\$1,909,994	\$2,636,484	\$2,288,004
Argentina.....	99,150	45,668	121,144	1,406,988	796,110	2,134,539
Germany.....	80,899	97,073	75,584	975,998	1,255,746	1,051,567
France.....	32,900	57,005	42,027	784,381	903,217	755,801
Russia.....	12,839	39,156	55,955	157,187	472,624	708,888
Belgium.....	48,896	44,772	28,993	608,779	544,860	406,260
Netherlands.....	38,510	53,780	26,917	496,241	759,767	387,981
Portugal.....	25,340	26,063	20,783	315,496	389,453	316,877
Denmark.....	17,570	24,764	18,031	207,595	312,361	231,611
Norway.....	16,026	24,429	17,608	203,049	298,525	227,173
Sweden.....	18,494	24,011	13,006	239,722	336,248	194,231
United States.....	11,202	3,507	15,134	98,838	29,018	188,980
Other foreign countries.....	18,854	21,896	37,350	244,137	338,868	549,685
Total.....	561,745	612,091	601,282	7,642,384	9,067,381	9,441,597
Australia.....	44,567	57,927	81,743	481,472	763,364	1,227,097
Natal.....	19,203	31,302	33,330	234,759	356,252	447,080
British India.....	4,754	9,604	11,685	52,056	119,891	152,895
Canada.....	32,339	1,128	10,088	302,428	15,583	128,115
British West Indies.....	7,031	7,135	8,121	85,616	88,015	110,362
Other British possessions.....	11,447	18,415	17,906	140,330	227,538	255,311
Total.....	119,341	125,511	162,873	1,296,661	1,570,643	2,320,860
Total imports.....	681,086	737,602	764,155	8,939,045	10,638,024	11,762,457
DRY HIDES.						
Russia.....	37,062	50,342	33,424	842,688	942,446	676,905
Netherlands.....	20,700	21,861	21,067	350,130	372,559	347,443
Brazil.....	11,416	17,298	16,521	225,829	334,698	347,687
France.....	16,940	22,924	19,765	243,923	337,477	331,880
China (exclusive of Hongkong, Macao, and Wei-hai-wei).....	18,244	15,659	28,564	272,275	266,844	516,019
Colombia.....	4,020	11,723	13,851	70,228	231,767	289,702
Ecuador.....	2,144	11,006	10,671	35,583	227,961	244,541
Madagascar.....	10,999	7,196	13,327	197,709	94,531	189,263
Germany.....	11,165	9,791	9,555	193,908	187,890	172,386
United States.....	1,930	4,877	2,372	27,179	79,066	53,448
Other foreign countries.....	37,320	46,820	45,862	619,359	770,230	758,434
Total.....	177,940	219,499	214,969	3,084,931	3,845,469	3,927,708
British India.....	53,879	88,590	118,196	845,578	1,366,484	1,893,698
Natal.....	26,158	38,818	47,479	513,566	691,802	910,619
Cape of Good Hope.....	26,212	30,956	26,954	474,537	564,153	541,816
Straits Settlements and dependencies.....	32,259	37,631	39,793	413,375	465,831	525,796
Australia.....	21,407	24,906	28,598	305,577	391,164	508,792
Other British possessions.....	19,520	28,533	40,947	275,804	471,680	722,962
Total.....	179,435	249,494	301,927	2,828,437	3,951,114	5,103,553
Total imports.....	357,375	408,993	516,890	5,913,368	7,796,583	9,031,261

REEXPORTS AND DOMESTIC CONSUMPTION.

In the following summary are given the quantity and value of the total imports and reexports, with the balance left for home consumption and the value per pound of the latter:

	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
Hides, dry and dry salted.....	<i>Cwt.</i> 257,575	<i>Cwt.</i> 468,993	<i>Cwt.</i> 516,896	\$5,913,368	\$7,796,583	\$9,031,361
Hides, wet salted.....	681,086	737,602	764,155	8,939,045	10,638,024	11,762,457
Hides entering on live cattle.....	287,347	241,005	114,670	3,099,726	3,147,166	2,150,316
Total hide imports.....	1,325,968	1,447,600	1,395,721	17,952,139	21,581,773	22,944,034
Reexports.....	306,800	425,383	410,964	4,884,671	6,759,047	6,848,187
Balance for home consumption.....	1,020,008	1,022,217	984,837	13,067,468	14,822,726	16,096,847
Value in cents per pound.....				11.4	12.95	14.5

The reexports of raw hides were taken principally by Germany and the United States. The values accredited to these countries during 1908, 1909, and 1910, respectively, were as follows: Germany, \$613,349, \$657,532, and \$979,504; United States, \$1,603,171, \$3,927,090, and \$3,178,350.

EXPORTS OF DOMESTIC HIDES.

The cattle kill in the United Kingdom is estimated at about 3,000,000 head per annum. The quantity and value of the exports of domestic raw hides in 1908, 1909, and 1910 are shown in the following table:

Countries.	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
Germany.....	<i>Cwt.</i> 57,502	<i>Cwt.</i> 50,518	<i>Cwt.</i> 67,929	\$493,701	\$473,700	\$653,940
Netherlands.....	6,982	5,838	11,379	85,020	99,485	211,084
France.....	13,072	15,550	11,686	141,230	169,349	178,902
Belgium.....	12,901	8,100	5,506	134,602	96,346	87,791
United States.....	104,759	136,111	58,945	1,246,787	2,004,696	903,932
Other foreign countries.....	14,189	21,008	13,919	225,148	300,389	198,324
Total.....	209,385	237,125	169,364	2,327,088	3,143,965	2,233,973
Canada.....	31,549	46,593	26,616	428,831	732,773	435,736
Other British possessions.....	1,635	1,366	982	21,242	20,410	16,706
Total.....	33,184	47,959	27,598	450,073	753,183	452,442
Total exports.....	242,569	285,084	196,962	2,777,161	3,897,148	2,686,415

TANNING MATERIALS—SOURCE OF IMPORTS.

Each of the tanners specially named works with what is termed the mixed tannage system, the materials used consisting of oak bark in small quantities, myrobolans, valonia, mimosa bark, oak wood, and chestnut extracts and quebracho. The cost of these is less than in the United States. Owing to the United States customs duty on foreign tanning materials, the English tanner can, on the whole, obtain his material cheaper than the American tanner, with the exception of chestnut extract, which is cheaper in the United States.

than in England. The English tanner claims, however, that this is due to the fact that he requires a higher and purer quality than is used by the American tanner.

Tanning materials are imported into the United Kingdom to the average annual value of \$8,000,000, more than \$6,000,000 worth of which is retained for home consumption. The following table shows the value and origin of the imports of tanning materials during 1908, 1909, and 1910:

Countries.	1908	1909	1910
BARK.			
Belgium.....	\$41,428	\$44,620	\$47,088
Germany.....	4,603	8,283	8,516
United States.....	3,791	4,696	569
Other foreign countries.....	45,978	8,861	15,400
Natal.....	747,518	969,961	966,759
Australia.....	58,548	40,182	25,680
Other British possessions.....	8,000	18,672	34,011
Total.....	909,866	1,096,245	1,098,063
TANNING EXTRACTS.			
France.....	1,772,500	1,836,976	1,890,716
Argentina.....	428,981	565,798	563,703
Austria-Hungary.....	407,214	415,891	336,685
Italy.....	387,796	416,411	286,456
Germany.....	101,228	103,773	188,681
United States.....	94,596	132,607	78,394
Other foreign countries.....	20,176	20,133	33,213
Canada.....	80,185	105,705	76,940
British North Borneo.....	38,211	33,408	51,789
Straits Settlements and dependencies.....	32,761	26,463	29,067
British India.....	22,254	30,435	16,988
Other British possessions.....	5,888	8,000	6,000
Total.....	3,391,789	3,665,620	3,558,581
GAMBIER.			
Dutch possessions.....	.....	5,752	67,985
Belgium.....	1,946	568	3,041
Other foreign countries.....	3,844	773	2,554
Straits Settlements and dependencies.....	849,716	817,902	680,922
Other British possessions.....	26,696	.....	.....
Total.....	892,102	825,020	754,502
MYROBOLANS.			
Foreign countries.....	729	.....	6,019
British India.....	1,209,699	745,153	1,089,780
Total.....	1,210,428	745,153	1,095,799
SUMAC.			
Italy.....	600,740	582,252	487,058
Other foreign countries.....	26,931	38,372	22,108
British possessions.....	3,503	2,734	5,173
Total.....	631,174	623,358	514,339
VALONIA.			
Asiatic Turkey.....	1,026,987	1,020,213	789,755
Greece.....	34,586	36,581	35,106
Other foreign countries.....	2,214	1,066	2,189
British possessions.....	987	.....	.....
Total.....	1,064,774	1,057,850	827,050
OTHER TANNING MATERIALS.			
Germany.....	16,701	16,915	4,374
Chile.....	.....	.....	39,511
France.....	9,582	4,769	1,061
Other foreign countries.....	5,577	25,373	5,372
British possessions.....	13,966	31,028	11,786
Total.....	45,826	78,085	62,094
Grand total.....	8,145,959	8,120,331	7,910,428

REEXPORTS AND DOMESTIC CONSUMPTION.

Bark constituted the principal reexport of tanning material, most of which was taken by Germany. The following table shows the value of the different materials reexported in 1908, 1909, and 1910 and the balance left for home consumption:

Articles.	1908	1909	1910
Bark.....	\$970,482	\$790,407	\$808,305
Extracts.....	174,877	288,516	177,987
Gambier.....	280,198	212,899	70,875
Myrobolans.....	409,413	229,387	174,624
Sumac.....	184,167	208,174	125,131
Valonia.....	72,252	29,801	21,179
Other materials.....	22,775	38,815	16,361
Total.....	1,814,164	1,797,999	1,454,422
Total imports tanning material.....	8,145,959	8,120,331	7,910,428
Balance for home consumption.....	6,331,795	6,322,332	6,455,906

TANNING METHODS.

The American tanner is more progressive than the British tanner; the latter is slower to undertake new processes and methods and hesitates to run risks; at the same time he carries on the various manufacturing operations with carefulness and precision.

Some of the smaller tanyards would probably be considered obsolete by an American tanner. The larger and more important, however, are equipped with machinery, and certain of the more progressive plants in Bristol, Warrington, Liverpool, Leeds, and Birmingham are equipped with the most modern and up-to-date machines available. Operations are carried on more rapidly in an American than in an English tannery; machines are run at a higher speed; rolling machines, for instance, are run 50 per cent faster than in England. The British tanner claims that the British sole leather is better finished and better tanned, and consequently takes longer to tan and finish than is customary in the United States. About five months is generally required for tanning good sole butts in this country, six to seven months for better-class heavy butts, three months for shoulders, and two months for bellies.

In the finishing or shed work, from a fortnight to three weeks is consumed, owing to the fact that the finishing required by the English trade must be carefully done, and the system of bleaching with soda followed by acid is not used by English tanners. An English tanner turning out 750 hides weekly requires as much shed room as an American tanner with an output of 3,000 hides per week.

Liming and soaking are more thoroughly done in the United States than is usual in England; more water is used and the hides are handled more during the liming process.

WAGES—TANNING COSTS PER POUND.

The scale of wages in England is lower than in the United States, much lower on the whole; but, it is again stated, the English market requires more work put into the leather than the American. The

average labor cost in tanneries throughout the United Kingdom is as follows: Hand unhairing, 5 cents per hide; hand fleshing, 4 cents per hide; general lime-yard work from green hide to tan house, 16 cents per hide. Machine unhairing works out at about the same as unhairing by hand, as the hides must afterwards be scudded at 1 cent per hide. Fleshing by machine is not in general use, as machines do not flesh clean enough for English requirements. The following shows the general wages paid:

Employees.	Weekly wages.	Employees.	Weekly wages.
Lime jobbers.....	\$6.80-\$7.30	Shed work (piece work in gangs):	
Unhairers.....	8.50	Butt gang.....	\$8.50-\$9.72
Fleshers.....	9.23- 9.72	Offal gang.....	7.78- 8.75
Tan house:		Foremen:	
Coloring pits workmen.....	6.42- 6.80	Lime yard.....	9.23-10.21
Butt lifters on layers.....	7.78- 8.50	Tan house.....	9.72-10.94
Belly gang.....	7.80	Shed.....	10.94-12.15

In a good English tannery the cost for ordinary labor, piecework and daywork combined, generally works out at about 2 cents per pound of finished leather. This is the average, and I am informed that anyone spending more than 2 cents per pound is exceeding what it ought to cost. Some English tanners bring the cost down as low as 1.4 cents per pound. These amounts include the wages paid to the superintendent.

The entire cost of tanning sole leather generally works out at 3 cents per pound of leather produced. This includes the tanning material, lime, oil, coal, and water—all materials, in fact, used for the production of leather. The actual tanning cost varies in different tanyards according to the quality produced, but the average and what may be termed rock-bottom price is, as stated, 3 cents per pound of finished leather. In certain establishments, tanning costs only work out at 3.4 cents, in others 3.6 cents per pound, seldom more.

As regards the percentage of raw hide saved in the finished leather it is difficult to make comparisons, since in the United States calculation is made on a salted basis and in England on a fresh basis. From a fresh, green market hide British tanners get 60 per cent of leather, from a salted hide they claim to be able to get 2 per cent more than American tanners. From a dried South American hide or from a dried Chinese hide the average yield in finished leather is about the same as obtained in the United States. The English tanner is a master of the art of blending materials and getting the best results in sole-leather tannage.

LIGHT LEATHER.

Between 400 and 500 firms are engaged in the manufacture of light leathers in the United Kingdom, but only about 50 of these establishments are of considerable importance. The exact number of upper-leather tanneries is difficult to ascertain. Production is not carried out under the specialized conditions existing in the United States, and many upper-leather manufacturers also make other sorts, such as legging leathers and fancy leathers for pocketbooks, purses,

and bookbinding. In very few cases is the entire output of a tannery limited to upper leathers. A list of the more important light-leather manufacturers in the United Kingdom, with address and description of trade, is given on pages 79 and 80.

NATURE OF OUTPUT.

The various light-leather manufactures may be divided into the following classes: Sheep leather, for uppers and linings, for roller-leather purposes, for bookbinding and fancy goods, and for skivers and chamois; goat, for upholstery, bookbinding, and fancy leather goods and for glazed kid; calf, for chrome calf, semichrome calf, and bookbinding calf; seal, for usual purposes.

With the exception of a few tanners who specialize in the manufacture of glazed kid, and box and willow calf, and who tan and finish the leather produced, the light-leather trade may be classified under two further headings, (1) tanners and (2) leather dressers.

Many producers of vegetable-tanned leathers confine their attention to tanning and do not dye and finish the leather, which is sold in the crust-tanned condition to leather dressers and curriers who dress and finish it. Practically every kind of market skin (dry, salted, and pickled) is tanned and finished in the United Kingdom, and large quantities of East India and other foreign-tanned goods are dressed and finished here.

A few firms specialize in chrome leathers; the only other specialized trade is the manufacture of sumac-tanned skivers and chamois, which are made in large quantities; some are dressed and finished in this country and others exported in the crust.

IMPORTS OF SKINS.

The following table shows the imports of undressed skins into the United Kingdom in 1908, 1909, and 1910:

Countries.	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
SHEEPSKINS, UNDRESSED, PICKLED.						
	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>			
Argentina.....	35,967	711,763	1,196,772	\$16,497	\$326,464	\$554,858
France.....	628,697	1,682,173	834,470	212,232	525,664	254,688
Netherlands.....	175,925	79,746	113,384	88,453	47,580	70,067
Russia.....	28,760	155,100	87,117	16,009	64,412	37,579
United States.....	87,391	35,098	94,195	38,859	13,558	28,001
Other foreign countries.....	295,378	316,820	498,117	112,382	151,552	243,315
Total.....	1,252,118	2,980,700	2,824,055	485,032	1,129,210	1,188,508
New Zealand.....	4,192,968	4,953,884	4,853,888	1,757,590	2,115,769	2,122,379
Australia.....	1,042,553	2,163,028	1,691,325	406,216	741,094	651,181
Other British possessions.....	314,066	543,829	119,272	97,972	201,249	58,112
Total.....	5,549,577	7,660,741	6,664,485	2,261,778	3,058,112	2,827,172
Total imports.....	6,801,695	10,641,441	9,488,540	2,746,810	4,187,322	4,015,680

Countries.	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
SHEEPSKINS, UNDRESSED, WOOL LEFT ON.						
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>			
Chile.....	4,540,595	3,904,385	4,441,509	\$580,223	\$488,090	\$562,071
Argentina.....	3,228,699	5,300,391	3,601,948	432,169	721,517	521,464
Russia.....	480,497	638,940	927,188	72,262	96,837	178,785
Turkey.....	456,850	284,356	1,023,894	66,705	41,190	163,888
Egypt.....	412,038	718,504	622,589	54,611	87,879	97,811
Spain.....	905,034	1,266,645	234,720	182,445	217,537	76,953
United States.....	204,290	106,890	28,893	36,605	25,510	4,861
Other foreign countries.....	2,136,522	4,045,007	2,543,841	330,396	648,212	398,128
Total.....	12,344,525	16,283,118	13,524,582	1,755,416	2,316,762	2,008,441
Australia.....	26,240,543	27,213,095	28,887,292	3,377,540	3,564,800	3,815,676
Cape of Good Hope.....	16,604,124	20,528,175	21,809,005	2,430,471	2,642,723	2,765,529
New Zealand.....	6,222,876	6,657,674	7,292,481	889,649	856,061	908,653
Natal.....	1,708,055	2,449,359	2,998,010	229,027	308,380	370,311
Aden.....	428,974	861,695	1,129,111	85,596	171,373	359,610
Other British possessions.....	339,978	711,640	903,301	42,937	95,208	127,487
Total.....	51,544,550	58,421,638	63,019,200	7,065,220	7,668,545	8,347,266
Total imports.....	63,898,075	74,654,756	76,543,782	8,820,636	9,965,307	10,350,707
GOATSKINS, UNDRESSED.						
	<i>Number.</i>	<i>Number.</i>	<i>Number.</i>			
Morocco.....	796,331	1,567,541	1,602,613	306,136	671,562	653,824
Egypt.....	456,296	422,677	712,748	190,781	191,691	332,051
Germany.....	199,746	178,811	248,171	242,950	210,140	275,161
Russia.....	1,397,371	356,522	445,262	702,839	188,805	251,924
China.....	216,605	273,796	377,098	81,178	121,370	189,056
Brazil.....	1,289,563	1,127,368	160,876	781,447	690,454	133,055
France.....	566,873	470,600	145,761	304,302	243,551	76,063
United States.....	97,960	32,425	78,629	46,572	15,577	32,955
Other foreign countries.....	246,207	383,261	406,839	120,406	201,083	230,341
Total.....	5,266,954	4,813,001	4,179,997	2,776,611	2,534,233	2,145,330
British India.....	3,537,774	8,563,767	5,062,869	1,589,058	4,169,130	2,543,291
Cape of Good Hope.....	2,068,004	2,355,886	2,160,969	1,453,735	1,724,507	1,586,970
Aden.....	265,850	409,322	888,396	111,535	169,412	403,865
Natal.....	118,640	131,240	81,916	72,009	88,234	34,284
Other British possessions.....	59,744	61,314	151,751	20,449	19,281	65,989
Total.....	6,050,012	11,521,529	8,374,901	3,246,786	6,170,564	4,634,399
Total imports.....	11,316,966	16,334,530	12,554,898	6,023,397	8,704,797	6,779,729
OTHER SKINS, UNDRESSED.						
China.....		13,854	120,124		5,231	42,387
United States.....	18,915	21,158	12,713	15,572	19,972	6,087
Other foreign countries.....	65,433	31,676	89,296	25,237	23,617	41,793
Total.....	84,348	66,688	222,133	40,809	48,820	90,267
Aden.....	87,110	141,490	632,270	3,902	10,618	61,030
Australia.....	12,700		50,927	5,455		30,814
Other British possessions.....	15,070	7,604	12,391	8,793	3,893	9,961
Total.....	114,880	149,094	695,588	18,150	14,511	101,805
Total imports.....	199,228	215,782	917,721	58,959	63,331	192,072

REEXPORTS AND DOMESTIC CONSUMPTION.

More than half the imports of undressed skins are reexported. The following table shows the value of the reexports, the total imports, and the balance left for home consumption:

Articles.	1908	1909	1910
Sheepskins, undressed:			
Wool left on.....	\$2,391,767	\$3,882,956	\$4,620,214
Pickled.....	2,357,536	3,894,999	3,009,117
Goatskins, undressed.....	4,372,049	6,676,035	4,450,208
Skins undressed, other.....	63,464	17,461	49,025
Total.....	9,184,816	14,461,451	12,146,564
Total imports.....	17,649,802	22,940,757	21,338,188
Balance for home consumption.....	8,464,986	8,479,306	9,191,634

The reexports of undressed skins were taken largely by the United States and France. Of the total reexports of goatskins, American purchases were valued at \$3,090,899, \$5,247,277, and \$3,329,094 in 1908, 1909, and 1910, respectively.

EXPORTS OF DOMESTIC SKINS.

Domestic skins, undressed, are exported in considerable quantities, as shown in the following table:

Articles.	1908	1909	1910
SHEEPSKINS, WOOLED AND PICKLED.			
Belgium.....	\$44,684	\$56,099	\$94,264
United States.....	1,712,604	2,088,872	2,181,140
Other foreign countries.....	53,492	52,859	88,502
British possessions.....	50,064	73,080	43,735
Total.....	1,860,844	2,871,510	2,407,641
OTHER SKINS.			
Belgium.....	1,317,273	1,233,760	1,708,821
Germany.....	115,370	144,116	141,342
France.....	62,962	35,136	83,572
United States.....	704,017	1,042,710	1,394,539
Other foreign countries.....	67,026	101,369	129,979
British possessions.....	19,903	1,552	2,141
Total.....	2,296,571	2,558,633	3,460,094
Grand total.....	4,156,415	5,430,143	5,867,735

COST OF RAW MATERIALS—WAGES.

The cost of the raw material consumed by British light-leather manufacturers is in most cases less than corresponding costs in the United States. The scale of wages is also lower and the output per hour much less than in an American tannery. Except in certain branches there is no recognized scale of wages; variations depend largely on the locality and differences in the cost of living.

The largest leather-dressing concerns are equipped with modern and up-to-date machinery. The various operations (fleshing, shaving, striking out, glazing, embossing, staking, and perching) are now

practically all done by machinery in these establishments. The prices paid for machine piecework vary considerably, dependent upon the class of work and the amount of labor expended in the different operations; for example, machine shaving varies from 3 cents per dozen in the case of "necking" and "backing" of East India tan-nages to 12 cents for the shaving of goods for furniture and book-binding purposes, and 16 to 24 cents for calf.

The time taken in tanning and finishing different leathers varies considerably; in the case of skivers it is usually three weeks to one month from the fellmongering of the skin to the tanned-crust article. For chrome goat and calf a somewhat longer time than that now given in the United States is usual, the liming process particularly being much more prolonged. For calf, the average time required from hair to finished state is about one month; for goat, from five to six weeks.

Because numerous varieties of leather in different grades are usually manufactured in the individual tannery it is very difficult to formulate a general or average wage scale. For morocco leathers, in which there is more or less specialization in manufacture, the following may be considered as the average labor cost per dozen for finishing high-grade goods: Rounding and seasoning, 16 cents; rolling on machine, 36 cents; graining, 48 cents; breaking down, 36 cents; topping, 16 cents; finishing, 28 cents.

COST OF MANUFACTURING GLAZED KID.

Glazed kid may also be considered a specialized product. The number of skins tanned and dressed by the ten principal firms—that is, their combined output—will average about 10,000 dozens per week. The largest firms are Ward & Co. (Ltd.), Charles Case & Sons, and the British Chrome Tanning Co. (Ltd.).

Wages in this branch of the industry vary; in some tanneries payment is on the piecework system and in others there is a weekly wage scale. The following may be regarded as an average labor cost: Lime jobbers, \$5.35 to \$6.08 per week; machine fleshers averaging 20 dozens per day, one man at \$6.57 and one youth at \$5.84 per week; fleshing by hand, 9 cents per dozen; unhairing by hand, 7 cents per dozen; unhairing by machine, averaging 20 dozens per day, one man at \$6.57 and one youth at \$5.84 per week; shaving, 7 cents per dozen; glazing, 8 cents first time and 10 cents second time per dozen; staking (twice), 10 cents per dozen; tacking on (when done), 4 to 5 cents per dozen.

Day wages are paid for the operations of puering, drenching, and tanning. The wages given obtain in London; they are an approximate average for Great Britain, although the scale is slightly lower in some provincial tanneries.

An actual cost statement for chrome-tanning Cape goatskins for glazed kids follows: Eight hundred skins weighing 3,212 pounds, or an average of 48 pounds per dozen, at 21.77 cents per pound; produced 7,795 feet of leather, or 2.42 feet per pound of pelt, the finished weight being 16 pounds per dozen. Detail of cost per square foot: Pelt, 8.95 cents; tanning materials, 1.19 cents; labor, 1.5 cents; oncost, 1.09 cents; total, 12.73 cents. The cost of labor includes foremen's wages, and the oncost includes all possible charges up to the point of the leather being ready for market, but not selling expenses or profits.

PRINCIPAL TANNING CENTERS.

The chief centers of the various lines of the industry may be summed up as follows: London for light and fancy leather manufacture—upholstery, bookbinding, and pocketbook leathers; Northampton for the dressing of leather for boot and shoe purposes; Leeds for upper and fancy leather manufacture and the tanning of East India kips; Nottingham for skivers and fancy leathers; the Manchester district for roller leathers. Upper leathers, specifically glazed kid, as has been noted, are made principally in Worcester, Leeds, London, Frome, Warrington, and Market Harborough; box calf and heavy chrome upper leathers in London, Leeds, Worcester, Northampton, and Glasgow; skivers at Nottingham, Stourbridge, London, Derby, Hitchin, Holt, and Torrington.

The manufacture of upper leathers is growing in both volume and efficiency. Although the domestic manufacturer is now handicapped greatly by not having taken time by the forelock, as did the American and German chrome tanners, there is a general sentiment that England should more largely supply the needs of its shoe-manufacturing industries in respect to upper leathers. As a practical means to this end technical schools or colleges are established, where are laid down model heavy-leather tanneries and light-leather factories. The course extends over two years and includes the technology of leather manufacture, scientific investigation, and manual work.

EXPORTS OF DOMESTIC LEATHER.

The following table shows the quantity and value of the domestic tanned, tawed, and dressed leather exported from the United Kingdom in 1908, 1909, and 1910:

Countries.	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>			
France.....	64,645	75,644	65,815	\$2,869,718	\$3,505,164	\$3,452,558
Germany.....	33,089	32,607	33,093	2,478,834	2,438,179	2,701,870
Belgium.....	12,301	14,844	14,780	696,668	901,236	1,006,007
Netherlands.....	7,658	9,169	8,636	560,309	723,152	670,642
Russia.....	4,640	3,444	2,868	453,066	315,198	327,580
Italy.....	3,522	4,074	4,325	217,814	281,361	339,623
United States.....	6,835	17,123	23,769	564,285	1,071,968	1,440,480
Other foreign countries.....	20,774	18,994	25,412	1,249,230	1,268,643	1,638,497
Total.....	153,464	175,989	179,298	9,119,944	10,504,891	11,579,157
British India.....	5,957	4,714	3,120	463,300	398,986	322,065
Canada.....	7,223	15,104	17,156	278,320	538,147	690,488
New Zealand.....	3,761	4,366	4,300	200,290	235,270	251,184
Australia.....	2,511	2,310	1,415	230,068	181,515	129,468
Cape of Good Hope.....	3,521	3,762	2,783	103,325	151,143	158,483
Other British possessions.....	6,921	8,124	12,482	315,135	356,797	622,736
Total.....	29,884	38,380	41,256	1,590,438	1,861,806	2,174,413
Grand total.....	183,348	214,369	220,554	10,710,382	12,366,699	13,753,570

Exports of varnished, japanned, and enameled leather are included in the foregoing, no separate returns having been made of the same prior to 1910, during which year exports of these leathers amounted to 1,262 hundredweight, valued at \$177,252.

LEATHER TRADE.

According to British statistics, of the total exports of sole leather from the United States in the fiscal years ended June 30, 1906, 1907, 1908, 1909, and 1910, the United Kingdom took 73, 73, 78, 82, and 82 per cent, respectively, in value. Of upper-leather exports from the United States, the share taken by the United Kingdom was for the same years 54.25, 54.29, 61.46, 59.24, and 55.66 per cent, respectively.

It is well known that certain of these imports are for reexport, but the home consumption is enormous and the proper furtherance of this trade demands careful study on the part of American exporters.

The imports of leathers undressed, dressed, and varnished, japanned, or enameled into the United Kingdom during the calendar years 1908, 1909, and 1910 were valued at \$46,130,644, \$45,629,544, and \$46,862,705, respectively. The following table shows the quantity and value of the imports, by countries of origin:

Countries.	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
LEATHER, UNDRESSED.						
Germany.....	Cwt. 53,125	Cwt. 66,108	Cwt. 60,931	\$712,392	\$1,066,147	\$1,017,847
Belgium.....	2,335	8,303	12,220	64,967	178,216	256,372
France.....	3,153	4,422	7,633	92,132	117,462	162,477
Netherlands.....	1,222	2,074	4,123	42,148	61,819	81,990
United States.....	299,262	315,947	397,482	5,384,285	5,936,190	7,968,188
Other foreign countries.....	13,744	13,514	11,665	414,372	467,417	389,193
Total.....	372,851	410,368	494,054	6,710,296	7,817,251	9,876,067
British India.....	267,814	298,469	279,368	11,235,663	11,032,759	11,558,015
Australia.....	86,601	81,421	74,654	2,126,456	2,007,080	1,785,348
Canada.....	56,482	43,465	46,523	1,276,692	936,012	1,095,361
Other British possessions.....	19,315	13,295	9,606	459,962	402,964	269,920
Total.....	430,212	436,650	410,151	15,098,773	14,378,845	14,708,644
Total imports.....	803,063	847,018	904,205	21,809,069	22,196,096	24,584,711
LEATHER, DRESSED.						
Germany.....	41,724	42,933	39,924	4,936,163	5,135,237	4,909,261
France.....	42,578	45,781	43,335	2,708,528	2,784,859	2,922,703
Austria-Hungary.....	2,300	2,720	2,432	188,022	214,184	240,818
Belgium.....	2,208	1,706	1,942	203,950	200,548	225,732
Russia.....	1,037	987	546	155,367	105,617	91,874
Netherlands.....	1,105	1,375	938	84,720	85,961	83,173
Italy.....	1,562	436	364	199,504	45,925	65,186
United States.....	252,870	200,591	164,950	13,867,675	12,659,567	11,677,658
Other foreign countries.....	1,378	1,568	1,787	82,258	94,599	107,578
Total.....	347,052	298,187	256,218	22,426,286	21,326,497	20,323,963
Canada.....	15,096	19,064	14,719	501,721	978,633	735,352
Australia.....	562	273	293	21,480	15,809	37,939
British India.....	189	10	8	13,854	437	875
Other British possessions.....	235	425	128	9,450	14,268	6,282
Total.....	16,682	19,772	15,148	546,505	1,008,847	780,448
Total imports.....	363,734	317,959	271,366	22,972,791	22,335,344	21,104,431
LEATHER, VARNISHED, JAPANNED, OR ENAMELED.						
Germany.....	7,695	6,234	6,208	1,271,781	1,033,256	1,066,999
Belgium.....	129	5	3	30,980	1,133	452
United States.....	154	280	692	13,606	39,929	98,843
Other foreign countries.....	172	92	130	19,217	10,091	12,394
British possessions.....	115	116	62	13,200	13,095	4,885
Total.....	8,265	6,727	7,095	1,348,784	1,098,104	1,173,553

REEXPORT TRADE.

The reexports of leather undressed, dressed, and varnished, japanned, or enameled during 1908, 1909, and 1910 aggregated \$7,088,313, \$7,821,156, and \$8,941,858, respectively. In the following table are given the quantity and value of the leather reexports, by countries of destination:

Countries.	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
LEATHER, UNDRESSED.						
	<i>Cwt.</i>	<i>Cwt.</i>	<i>Cwt.</i>			
Germany.....	20,808	28,432	51,000	\$1,121,543	\$1,648,478	\$2,917,554
France.....	4,092	6,048	5,540	320,284	456,920	783,753
Austria-Hungary.....	11,063	9,073	12,501	638,787	369,846	528,119
Netherlands.....	32,081	20,227	7,256	1,624,117	1,202,254	408,094
Belgium.....	581	5,296	7,467	24,069	270,621	294,451
United States.....	26,778	32,332	20,425	1,300,202	1,609,147	1,114,200
Other foreign countries.....	2,412	2,688	3,177	77,250	84,910	96,538
Total.....	96,996	104,096	110,375	5,323,252	5,672,176	6,112,018
Canada.....	3,006	2,128	523	85,757	58,003	20,006
Australia.....	52	48	65	4,063	2,530	3,756
Cape of Good Hope.....	30	164	108	841	4,865	3,022
Other British possessions.....	432	195	476	11,222	6,749	16,560
Total.....	4,210	2,535	1,172	101,883	72,177	44,045
Total reexports.....	103,206	106,631	111,547	5,425,135	5,744,353	6,156,063
LEATHER, DRESSED.						
Switzerland.....	1,274	1,651	2,748	176,206	230,219	448,973
Austria-Hungary.....	501	877	1,525	100,181	179,530	350,843
Germany.....	2,390	2,045	1,811	312,911	355,098	297,649
Russia.....	308	469	753	22,707	70,345	215,306
France.....	1,650	1,224	896	159,280	172,590	140,494
Sweden.....	179	480	4,342	8,528	20,096	148,453
Belgium.....	1,141	1,446	852	135,098	196,261	122,119
Netherlands.....	1,897	1,650	968	117,097	198,660	111,097
United States.....	3,717	3,462	3,231	440,559	426,237	518,068
Other foreign countries.....	1,916	1,474	2,094	83,007	94,210	172,186
Total.....	14,973	14,778	19,550	1,555,874	1,962,846	2,543,267
Victoria.....	173	405	427	20,113	55,643	64,578
Canada.....	240	468	328	26,210	40,041	44,621
New South Wales.....	260	291	347	23,154	35,355	37,145
Other British possessions.....	806	850	815	61,230	64,729	66,924
Total.....	1,479	2,014	1,917	130,707	195,768	213,268
Total reexports.....	16,452	16,792	21,467	1,686,581	2,158,614	2,756,535
LEATHER, VARNISHED, JAPANNED, OR ENAMELED.						
Germany.....	7	13	195	1,615	2,121	47,477
Sweden.....	2	150	103	793	37,899	22,273
Turkey.....	70	95	92	14,764	19,334	20,429
United States.....	127	96	116	24,653	14,096	18,789
Other foreign countries.....	147	76	92	28,863	18,118	18,254
Australia.....	13	79	63	2,550	11,747	12,390
British India.....	55	27	8	10,321	5,611	1,270
Other British possessions.....	23	14	29	3,810	2,170	3,503
Total reexports.....	444	550	608	87,369	110,588	144,304

IMPORTS FOR DOMESTIC CONSUMPTION.

The value of the imports for home consumption (total imports less reexports) is shown in the following statement:

Classes.	1908	1909	1910
Undressed.....	\$16,383,934	\$16,451,743	\$18,428,648
Dressed.....	21,326,294	20,278,089	18,335,806
Varnished, japanned, or enameled.....	1,332,103	1,078,576	1,156,391
Total.....	39,042,331	37,808,398	37,920,847

MARKET FOR AMERICAN LEATHER.

Upper leathers of American manufacture that find a market in Great Britain include glazed kid, calf, patent sides and patent colt, sheepskins, and genuine kangaroo. In bottom leathers the largest trade is in hemlock sole, followed by oak sole and a certain amount of union leather; the latter, however, finds a limited market.

While London is the center of the leather trade, most of the business naturally originates in certain districts, in which many London firms have branches; these include the shoe-manufacturing centers, Leicester, Northampton, Stafford, Norwich, and Bristol. Northampton buys a high-class leather; Stafford also demands leather of the better class, while Leicester buys a cheap medium and medium fine, and Kettering a medium and cheap.

In glazed kid practically all grades can be sold from 7 or 8 cents up to 35 cents per foot. The present demand is principally for black goods. Leicester manufacturers buy glazed at 8 to 24 cents per foot, the bulk of the trade being in cheap medium and medium fine grades at 12 to 18 cents. Skins ranging from 3 to 6 feet and of fairly medium substance are used. Formerly 7, 8, and 9 foot skins were taken by the Leicester trade; at present, however, in only rare instances is this class of stock bought.

In Northampton the demand is principally for 3 and 4 foot skins, heavy and medium heavy, for men's work. Manufacturers turning out women's goods use medium and some light medium. There is also a demand for 5 and 6 foot skins for cheaper-grade work in full medium to heavy substance.

The trade in Stafford is principally in 3 and 4 foot skins, medium and medium heavy, with a limited demand at certain seasons for medium light. In low grades Stafford manufacturers use some 5-foot skins, seldom, however, paying less than 16 cents for bulk lines. Leather importers state that the light and light medium American leathers are not easily sold on this market.

GLAZED KID.

American manufacturers meet competition in British-made glazed kid, also French, German, and other Continental stocks; of the latter the principal brands are the Grison (French) and Mayer and Feistmen (German). Although it is not claimed that the majority of the domestic glazed goods are equal to the best American, a ready sale

is found for the home product. In this connection note should be made of the loyal and creditable sentiment in England regarding the purchase of British-made goods of all sorts whenever practicable.

In the higher grades the output of domestic glazed kid is very limited. The prices for some lines are lower than for corresponding American goods, especially the cheap grades, from 14 cents per foot down. The average better grades are 18 and 20 cents per foot, while the bulk is in grades from 8 to 16 cents. The selections are necessarily not large, but the lines made are salable and good for the grades. It is claimed that certain Continental houses dump their cheap grades in 5, 6, and 7 foot glazed skins on the English market, as on the Continent higher prices may be obtained than in England for the smaller sizes and better grades.

CALF AND PATENT LEATHER.

While in glazed kid American goods are given preference, in calf and patent leathers and sheepskin of various kinds German manufactures hold first place. Statements are conflicting; on one hand I am told that "German tannage renders the leather more mellow"; on the other, that "American tanners make as fine a chrome calf as there is on the market." All agree, however, in attributing German leadership largely to price and finish.

Owing to French and German competition, the sales of American calf leathers have suffered somewhat during the last four years. English calf tanners, too, have suffered greatly. The French manufacturers, who were slow to change to the chrome tannages, have sold cheaply because they needed the trade, and German manufacturers, principally Freidenberg and Heyl, have succeeded in making great inroads. One feature of this competition is that the Continental market buys calfskins from 8 to 11 and 12 feet, on which certain German houses, it is stated, keep up prices, while they sell to England the 12 to 14 foot skins, which are good leather but not salable on the Continent, at prices that are practically irrespective of value, because of one house cutting against another.

It is not intended to infer that all German calfskins used in England are of the cheaper grades; certain lines are stall-fed and of a high-grade quality, yet a vast quantity of the cheaper grades is used in the manufacture of English boots and shoes.

In recent years a very large business has been done in England in German calf; thousands of dozens have been sold at prices so low that the ordinary American tanner could not compete. However, one well-known American tanning firm has catered to the requirements of the English market, using certain pelts, and is making a good leather and selling it successfully at a low price.

HANDICAPS TO AMERICAN TRADE—BOX AND RUSSIA CALF.

Higher-priced American leathers have been handicapped, both by the price offered by German competitors and by the fact that German tanners have produced what pleases the English trade—a fine-grained leather. American calf leathers are usually considered of too heavy grain, and even though the American leather at the same price may be as good as, if not better than, the German stock, the

finish of the latter gives it preference in this market. I am told the American tanner is unwilling to change the finish of his calf leather, since he considers it better than the German. No doubt it is, from the American point of view, but the question is rather one of catering to a trade requirement. The fact that German houses at times have sold 2 to 3 cents under American market prices has somewhat discouraged importers of American calf leather.

Certain German cheap stocks are well known in England, and reputation carries a long way. As to better grades, some shoe manufacturers have advertised the fact that they use only "C. F." or "C. H." calfs, and as retailers have come to demand these leathers the manufacturer who wishes to push his line must continue the stipulated article.

Trade in box calf has fallen off considerably, the newer finishes, glazed and gun metal, now being preferred. Russia calf is practically abandoned, colored chrome calf in medium heavy to heavy substance having taken its place for men's work. Large quantities of box sides are sold in the cheaper makes, at 15 cents to 19 cents, for the lower grades of men's and women's boots and shoes. Genuine kangaroo in different finishes is used in small quantities by custom shoemakers.

SOLE LEATHER AND SPLITS.

More or less is heard in England regarding adulteration of American sole leather. The British tanner considers British sole leather better tanned and consequently less absorbent than the average American. The American tanner may hold that the best American tannages are as good, yet the prejudice remains. Nevertheless, Great Britain buys large quantities of American tanned sole leather.

The climate throughout the United Kingdom is damp—much different from that of the United States—and the custom of wearing rubbers or overshoes is by no means so general. Union sole leather has only a limited sale, being used principally by certain firms manufacturing footwear for export to drier climates.

American oak sole leather is, as a rule, considerably higher in price than English oak sole leather, which is partly accounted for by the existence of many small tanneries in Great Britain which turn out comparatively small quantities and which sell their output on the basis of hide prices and market conditions.

American hemlock sole leather, both acid and nonacid, is consumed in large quantities. It is bought in sides from very light weights to heavy weights and used for commoner work. In the higher-grade shoe the present fashion demands a white bottom, and an English sole leather having a white finish is employed. When a hemlock bottom is used the sole is often painted over.

The decrease in the imports of splits shows the tendency of the British consumer to wear a higher-class shoe, for while the trade in splits has shown a marked decline the total imports of glazed kid and calf have materially increased. The present demand for splits is limited to manufacturers of the heaviest kinds of cheap boots and shoes. The cheaper chrome sides, made from cowhides or East India kip, and chrome calf have largely taken the place of fine calf splits, which were used some years ago in connection with wax calf.

Common splits can now be sold in England only in such districts as Leeds and Bristol, where heavy nailed work is made. One detriment to the sale of American splits is said to be the amount of adulterants introduced into the leather, making the goods weigh heavily, attracting the moisture, and showing a white bloom when in the boot.

TRADE METHODS.

While England buys enormous quantities of leather for home use and reexport, the trade is largely limited to certain houses, competing dealers and agents buying from the same house. There is no question that competition is keener here than in the United States. Complaint is made that many leather exporters sell to whoever wishes to buy, and that when three or four different houses find themselves handling the same line they are apt to cut against each other to get trade; after a time the profits become so small that the line is dropped and discredited to would-be customers, while another line on which profits are larger is pushed in its place. The ultimate result is to shut out that particular leather from the market.

American leather houses are well represented on the English market, but agents in London state that more business could be done if American tanners were to deal on a more equitable basis. The idea still exists here that when business is poor in the United States trade is pushed in England, but when trade is good at home the foreign market is neglected. In fact, I am told that in many instances American leather exporters do only a spasmodic trade. When certain lines are wanted by both the English and the home market, preference is given to the latter. The importer here concedes that this is "probably business;" nevertheless he considers it "poor export business."

There is complaint that so few American leather houses make standard selections, necessitating a continual sampling of goods. It is stated that some years ago British manufacturers placed contracts for the season, but unsatisfactory deliveries have compelled the importer to carry large stocks so manufacturers may inspect the goods. The British buyer insists upon regularity. When a grade is bought, that grade is desired, each bundle as nearly alike as possible, and the buyer is unwilling to take lots on the average. I am told that in a 100-dozen lot it is not uncommon for a manufacturer to reject perhaps 10 dozen as not up to sample.

VIEWS OF IMPORTER.

An importer of glazed kid in London wrote me as follows:

When prices of raw stocks are on a certain basis, say in October when the season starts for the spring trade, and contracts are taken on sample bulk shipments of 100 to 200 dozen the contract is placed; when prices of raw goods go higher American leather manufacturers alter their selections to suit the price. In other words, they do not give the people what they contracted for. The consequence of this is that when a man places an order, say from November to March, November and December deliveries probably come all right, while February and March are perhaps 5 per cent or 10 per cent less value, according to market conditions. American manufacturers claim that their skins are received in the same way. They do not consider it policy to keep the selection and alter the price, because it is not in general use in America to do so. It would be a more straightforward and honest way. While American manufacturers for some time past have done the bulk of the trade in Europe, it has been because glazed kid had a slump in America and they pushed trade in Europe. It is a question if

they will hold that trade when they get busy on the other side, because as soon as they are busy they let the foreign trade they have built up suffer. The consequence is English manufacturers can not depend upon delivery.

American manufacturers are, of course, handicapped by distance. Twelve to 15 days is required by mail steamer for delivery from the United States, and 3 to 4 weeks by ordinary freight steamer.

English shoe manufacturers are coming to buy goods as wanted instead of holding stocks. Some years ago it was the custom to place the contract, make arrangements for payment, and have the goods on the shelf; at present, the manufacturers consider it advantageous for the merchant or importer to hold the goods and he (the manufacturer) take them as needed. Consequently, the leather importer must hold large stocks or lose trade if lines required are not on hand, since the manufacturer who buys according to requirements can not wait three or four weeks for delivery.

TERMS OF CREDIT.

The banking system in England differs from that of the United States. English banks discount two-name paper but will not discount an individual firm's paper. The most allowed is an overdraft on call or security for a loan, which usually means a mortgage.

Consequently, when a shoe manufacturer wishes to buy a large parcel of leather, say, for the spring run (the goods to be made during November, December, and January for delivery in March), terms must be arranged with the leather importer. Some of the best leather houses are compelled to give three and four months acceptances; a good house can discount the same with its bank, but the shoe manufacturer can not go to his own bank, discount his own draft, and get the money to take cash discount.

The usual terms extended to the manufacturer by the leather merchant are $3\frac{1}{2}$ per cent prompt cash, $2\frac{1}{2}$ per cent for 30 days, afterwards net. American leather exporters usually give 30 or 60 days from date of invoice. The English importer states that, as it takes 3 to 4 weeks to get the goods, if the terms are 30 days the invoice is frequently paid before the goods are received. The importer does not get his money back under 60 days—in most instances 90 days—and he must necessarily have a large capital to carry accounts. Undoubtedly for the banker and for the business community it is a safe way of doing business. From the leather merchant's point of view, since he trusts the customer, it is felt hard that banks should not consider his commodity money and trust the credited accounts. Many houses are hindered in increasing their business by the fact that they must keep within their capital. Again, the leather merchant usually has to bear the cost of ocean freight from the United States, and frequently land transportation on this side as well; the consumer requires his goods to be carriage-paid to factory.

Some American firms, on principle, insist on draft attached to bill of lading. Considerable more business might be done if prospective customers were looked up, and when found good given extended terms. The credit system on the Continent being an elastic one, the English importer meets with no objection there as regards time asked. In spite of frequent and varied complaint regarding our credit system, it is admitted that an American leather house with an output selling

well on terms of 10, 30, or 60 days has reason to object to terms of 3 or 4 months and perhaps can not afford to send on such terms goods which take practically months to put on the market.

PROSPECTS FOR AMERICAN TRADE.

The outlook for the American leather trade with England is, on the whole, good. The quantity of exports from the United States to the United Kingdom may decrease, however, because American leather manufacturers are doing more business direct with the Continent. This trade was formerly done through the English importer, and considerable quantities of leather destined for the Continental trade were thus accredited to England. I am told that in glazed kid business can be increased still more; in this line American goods are given preference, the statement being made that, on the whole, most American kids are superior in tannage and finish to many European products. Goods of domestic manufacture are making inroads in many instances into the American glazed-kid trade. British tanners are gradually improving their product, for which a ready sale is found, and the output will no doubt be largely increased.

American glazed kid can be sold, as previously stated, in all grades and all substances from 8 to 35 cents per foot. The demand for grades from 24 to 35 cents per foot, however, is somewhat limited. Up to 20 cents per foot, 3-foot, 4-foot, 5-foot, and 6-foot skins can be sold; from 20 to 24 cents up per foot, 3-foot, 4-foot, and 5-foot skins are salable. Large skins have no market except in full-medium and heavy substance at 14 cents per foot and under. The most salable glazed lines are those from 14 to 22 cents per foot, 4-foot and 5-foot skins, medium to medium heavy, including 25 per cent of light medium. Medium, medium-heavy, and heavy substances are always salable in good tannages in black. The demand for colors has somewhat diminished since last season, and the present outlook is that this class of stock will be used principally in low-priced shoes. There is always a certain demand in England for medium-priced colored glazed kid for children's footwear.

If manufacturers were to furnish the finish desired, business in calf leather undoubtedly could be increased in spite of the fact that sharp competition with Germany must be met. Whatever the cause may be, more German calf leather is sold in England to-day than any other. My investigations lead me to state, however, that while reputation and price count for considerable the fact that German calf is finished to suit the British buyer also counts for much.

It is characteristic of the British trade, if satisfied, to stick more closely to a certain make or selection than is the general rule in the United States, and American exporters would find it greatly to their advantage to cater more carefully to this trade. To tell the buyer here, "This is what we make and this is the way the goods come, we can not make different arrangements," does not tend to increased orders. While the demand for leather is practically the same in England as in the United States, certain requirements differ, and if the American leather exporter is genuinely desirous of increasing his trade with this country these requirements should be met as far as possible.

AMERICAN STATISTICS OF EXPORTS.

The following table shows the exports of leather from the United States to the United Kingdom during the fiscal years ending June 30, 1908, 1909, and 1910:

Articles.	1908	1909	1910
Sole leather.....	\$5, 159, 280	\$5, 680, 451	\$6, 891, 646
Glassed kid.....	1, 086, 615	2, 177, 519	4, 938, 708
Patent or enameled.....	5, 909	31, 104	68, 951
Splits, buff, grain, and all other uppers.....	9, 428, 241	10, 454, 801	8, 686, 484
All other leather.....	689, 084	592, 459	582, 813
Total.....	16, 970, 129	18, 936, 034	21, 172, 602

BOOT AND SHOE TRADE.

Boots and shoes are imported into the United Kingdom to an annual average value of nearly \$3,500,000. The total exports (including reexports) during 1908, 1909, and 1910 were valued at \$10,336,873, \$11,335,437, and \$14,949,854, respectively.

In the following table are shown the quantity and value of (1) the total imports into the United Kingdom, (2) imports retained for consumption, and (3) exports of domestic manufactures:

Countries.	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
IMPORTS.						
	<i>Doz. pairs.</i>	<i>Doz. pairs.</i>	<i>Doz. pairs.</i>			
France.....	19,308	24,333	20,129	\$453,095	\$509,100	\$479,797
Austria-Hungary.....	26,043	28,843	24,814	596,010	496,560	395,894
Switzerland.....	28,774	31,700	26,963	418,758	462,398	361,408
Germany.....	16,545	17,811	20,806	217,596	195,429	228,681
Netherlands.....	2,166	2,233	3,178	22,842	28,291	38,707
Belgium.....	1,668	691	1,813	18,808	11,173	28,474
United States.....	69,743	77,964	70,210	1,758,587	1,853,182	1,741,417
Other countries.....	1,216	202	293	12,432	3,731	3,906
Total.....	175,453	183,927	168,236	3,472,124	3,590,964	3,278,279
IMPORTS RETAINED.						
France.....	17,987	23,535	18,002	427,023	552,090	452,488
Austria-Hungary.....	28,248	31,997	16,031	480,850	398,086	324,687
Switzerland.....	27,542	30,822	25,694	401,403	445,412	343,795
Germany.....	15,192	16,877	19,088	202,850	178,308	200,386
Netherlands.....	2,157	2,215	3,164	22,612	28,186	38,483
Belgium.....	1,657	673	1,806	18,774	10,924	28,254
United States.....	67,519	75,474	66,776	1,708,797	1,799,731	1,673,309
Other countries.....	337	201	213	3,521	9,956	3,123
Total.....	160,589	171,495	150,674	3,275,840	3,424,283	3,073,394
EXPORTS.						
France.....	31,920	43,240	51,297	964,486	1,269,246	1,528,674
Belgium.....	11,982	21,248	30,734	240,132	419,096	633,710
Egypt.....	19,010	24,508	29,578	331,320	406,613	496,674
Argentina.....	16,567	22,769	31,577	243,826	282,251	430,470
Netherlands.....	24,037	33,836	39,830	197,199	250,882	294,919
Germany.....	10,379	12,948	16,280	185,661	221,263	275,317
Turkey.....	1,714	3,599	16,890	28,331	73,702	320,887
Italy.....	1,694	3,208	7,736	44,795	83,017	201,541
Chile.....	4,029	6,345	8,353	60,741	71,941	104,785
Peru.....	3,320	6,303	6,883	53,423	112,743	142,285
Other foreign countries.....	24,077	28,112	58,646	383,688	431,439	804,667
Total.....	148,729	206,116	292,804	2,733,553	3,622,793	5,232,999
Australia and New Zealand.....	148,894	157,562	196,971	1,427,338	1,368,872	1,739,530
British India.....	64,915	66,911	83,646	942,893	949,156	1,173,304
Cape of Good Hope.....	162,352	161,032	181,196	1,971,491	1,868,488	2,310,784
Transvaal.....	81,514	92,063	127,021	1,165,993	1,341,079	1,838,665
British West India.....	33,809	35,924	29,022	303,206	320,263	344,351
Natal.....	44,773	41,746	51,474	639,004	610,477	727,025
Canada.....	7,106	11,553	25,290	67,945	123,984	263,594
Orange River Colony.....	10,219	11,487	15,014	139,647	153,888	213,730
Channel Islands.....	17,407	18,059	17,807	166,842	177,803	167,539
Straits Settlements.....	5,936	7,649	10,590	101,101	138,886	153,247
Rhodesia.....	6,176	6,214	9,459	100,052	111,584	162,058
Other British possessions.....	32,367	33,034	36,345	381,525	383,173	447,943
Total.....	615,468	633,864	793,834	7,407,087	7,546,963	9,512,070
Total exports.....	764,197	839,980	1,086,638	10,140,589	11,169,756	14,744,969

BRITISH AND AMERICAN EXPORT TRADE.

It will be noted that Great Britain's boot and shoe exports consist very largely of domestic products, comparatively small quantities of imported footwear being reexported. The import trade during the three years for which detailed returns are given scarcely held its own, while the export trade constantly increased.

Attention is called particularly to the steady increase in British exports to various South American countries—Argentina, Peru, and Chile—and American shoe manufacturers are again reminded of the importance of the South American market.

The United Kingdom, as is well known, is the strongest rival the United States has in the manufacture of footwear and also the strongest competitor in the export boot and shoe trade. More boots and shoes have been exported from the United Kingdom than from any other country in the world, although as regards value per pair American exports lead the British, and as regards total value of exports the United States has made rapid strides toward first place during the past few years.

The following table gives the quantity and value of the boots and shoes of domestic manufacture exported from the United States during the calendar years 1908, 1909, and 1910:

Countries.	Quantity.			Value.		
	1908	1909	1910	1908	1909	1910
	<i>Pairs.</i>	<i>Pairs.</i>	<i>Pairs.</i>			
United Kingdom.....	828,449	842,055	752,176	\$1,885,340	\$1,834,413	\$1,717,373
France.....	77,906	132,751	123,417	254,246	425,742	370,068
Germany.....	178,443	189,628	251,059	460,444	535,795	658,972
Other Europe.....	129,875	146,759	191,160	345,771	420,056	586,475
Canada.....	623,890	654,569	796,977	1,128,049	1,173,560	1,492,455
Central America.....	401,958	460,658	525,781	649,220	827,655	987,423
Mexico.....	660,714	642,787	789,627	1,309,945	1,350,537	1,650,740
Cuba.....	1,908,768	2,500,327	2,848,304	2,201,252	2,907,473	3,138,109
Other West Indies and Bermuda.....	533,697	575,577	646,705	555,887	602,848	683,228
South America.....	238,422	237,698	335,164	460,604	539,234	800,037
British Oceania.....	104,372	87,740	86,259	225,400	193,627	198,735
Philippine Islands.....	181,766	191,398	300,683	317,254	375,861	582,089
Other countries.....	104,544	111,987	163,591	237,815	256,424	350,543
Total.....	5,967,793	6,773,934	7,810,903	10,031,227	11,443,225	13,216,237

EFFORTS OF MANUFACTURERS TO SUPPLY HOME MARKETS.

Although imports of American-made boots and shoes are not increasing, there is a steady demand for high-class American-made footwear. The value of the imports has fluctuated somewhat during the past five or six years, yet, due importance being given to existing circumstances and conditions, we may consider our boot and shoe trade with Great Britain an excellent one.

Wages in the shoe industry of the United Kingdom are much lower than in the United States; at the same time the output per machine and per operator is much smaller. However, the productive cost, in fact, the entire cost of manufacturing the finished product, is, no doubt, considerably less in the United Kingdom than in the United States.

It is admitted that American competition has been a large factor in forcing the British manufacturer to adopt modern methods of manufacture, install American shoemaking machinery, build his

shoes on American-shaped lasts, manufacture half sizes and many different widths; in fact, to improve his product to the extent of his genius and ability. The British manufacturer has nobly risen to the occasion, and while, generally speaking, style and finish are lacking to a certain degree in most British boots and shoes, and while there is a certain undefined difference even in the best grades, as compared with American products, wonderful progress has been made toward overcoming what was five years ago a notable disparity.

Again, the home manufacturer always possesses certain advantages over foreign competitors. The latter must reckon with the cost of doing business at long distance, the disadvantage of delays attendant upon delivery of orders, the knowledge of trade customs and requirements possessed by the home manufacturer, etc.

The English buyer is more inclined, perhaps, than many others to be loyal to the industries of his own country. By many English buyers an imported article is apt to be considered inferior to one "made in England." Consequently the English consumer has often to overcome a certain amount of prejudice against the American shoe.

British manufacturers of high-grade footwear that competes most largely with the American are to-day producing a boot or shoe, made on the same lines as the American product, which they consider equally as good, and which, it must be admitted, value for value, discounts the American-made product of like grade. Certain of these manufacturers have well-appointed retail stores established throughout the Kingdom. These goods are sold to the retail trade at the same prices as the American high-class lines, usually at the uniform value of 16s. 6d. and 21s. (\$4 and \$5.10). Special and fancy lines are retailed at \$5.83, \$6.08, \$6.80, and \$7.30, both British and American made.

CLASS OF AMERICAN SHOES SOLD.

The market for American-made shoes is now found largely among the middle classes; I might say, among the upper-middle classes. Those in higher station prefer "bespoke," or custom-made footwear, while persons of the lower class buy the cheaper grades of domestic products.

Medium American styles are the best sellers; extreme, or freak, shapes are not desired. Both men's and women's goods of American make find a better sale than youths' or children's; the latter are not in good favor and sales are limited. Girls' and boys' American-made shoes usually retail on this market at \$2.55 and \$2.92.

Boots and shoes most in demand are those made from patent leather, chrome wax calf, and patent and glazed kid, with medium heels, wide width, all weights of sole according to kind of shoe, and in medium to large sizes.

Goods of French and Austrian manufacture are found in competition, principally in women's lines, also a few Swiss goods. A well-known French firm (Raoul) maintains its own retail establishment and sells high-grade French-made footwear generally in two uniformly-priced lines, corresponding to the American and English made goods at \$4 and \$5.10. Special and fancy lines are carried and sell at correspondingly higher prices. Large quantities of women's slippers of Austrian production are sold in the United

Kingdom. A well-made satin slipper, or court shoe as it is usually named here, is sold at 5s. 11½d. to 16s. (\$1.45 to \$3.90), according to elaborateness of detail.

The demands in Scotland and Ireland are much the same as in England. American styles in medium shapes are generally desired, and practically the same leathers, with a larger proportion of heavier lines for the two northern countries. It is stated that American boots and shoes give excellent satisfaction as regards comfort, but that the bottom leathers are too porous to meet the needs, especially in Scotland and Ireland. One American manufacturer now imports sole leather from England for use in footwear made for the British trade.

PROSPECTS FOR AMERICAN TRADE.

As regards prospects for American shoe trade with the United Kingdom, the condition of the domestic industry admittedly never has been better than during 1911, the output having been a record one, with practically no accumulation of stocks. American shoe houses generally state that their business was very fair throughout the year, with no largely increased demands, but an even tenor of trade.

There has been a gradual decline both in the manufacture and in the demand for heavier goods, while sales of the more up-to-date and lighter-fashioned footwear, it is stated, were never so large as during the summer of 1911. That the season was a record one for warmth and sunshine throughout the United Kingdom was undoubtedly a factor in bringing about this result, yet the tendency toward the adoption of lighter-weight goods is, I find, fairly general and especially true of the London trade.

The feeling regarding the coming year among British manufacturers at present seems one of optimism, tempered by fear in some quarters as regards the hardening of leather prices. Among manufacturers of high-class lines I find a strong sentiment that every effort must be made to produce smart footwear in greater variety and with more attention to the changes of fashion. British manufacturers are fully aware of the trade value of the quality of their present products and are more than ever alive to the importance of style and appearance in limiting imports and in increasing their own foreign sales.

These facts are mentioned that the American manufacturer may understand the situation as regards the present British competition. To the American manufacturer not already established on this market I venture to suggest that, generally speaking, no very satisfactory measure of success can be expected from placing small lots with various agents or dealers. The trade in American-made footwear throughout the United Kingdom is too well established to admit of profitable competition along these lines. However, I believe the American manufacturer who possesses good first-hand knowledge of present conditions, who is determined to enter the British market, and once entered to hold his position on the merits and quality of his production, and who has sufficient output and capital to warrant the establishment of retail stores of his own, will receive satisfactory returns from his outlay, despite the keen competition he is bound to meet.

APPENDIX.

BOOT AND SHOE MANUFACTURERS.

ENGLAND—LEICESTER AND DISTRICT.

Names of firms.	Address.	Weekly production and class of work.
LEICESTER.		
Allen, A. F. & Co.....	Willow St.....	300 dozen boys' and girls' nurseries machine-sewn medium.
Allen, C. G. & Son.....	70 Oxford St.....	200 dozen 4 to 6 up to men's machine-sewn medium.
Andrews & Co.....	14 Bartholomew St.....	100 dozen boys' and girls' machine-sewn common.
Archer & Gamble.....	Slate St.....	450 dozen boys' and girls' machine-sewn common.
Bagshaw, J. A.....	Empire Rd., Tudor Rd.	150 dozen women's machine-sewn common.
Bates, W., & Co.....	58 Queen St.....	350 dozen children's machine-sewn common.
Bayes, W. J., & Co.....	Beatrice Rd.....	150 dozen women's machine-sewn medium.
Beal, Samuel.....	Humberstone Rd.....	170 dozen women's machine-sewn medium.
Beal, T. W., & Co.....	Crafton Street Works.	100 dozen women's and football machine-sewn medium.
Billings Bros.....	108 Wilkiv St.....	100 dozen children's machine-sewn.
Branson Bros.....	Wanlip St.....	80 dozen girls' machine-sewn medium.
Brown, Thos., & Co.....	Humberstone Rd.....	700 dozen women's machine-sewn medium.
Brunswick Boot & Shoe Mfg. Co.....	Brunswick St.....	250 dozen girls' and boys' machine-sewn common.
Chapman Bros.....	40-42 Sanvey Gate.....	150 dozen women's machine-sewn common.
Clarke, J. G., & Co.....	Sanvey Gate.....	2,400 dozen all classes machine-sewn canvas.
Coleman & Lewitt.....	Havelock St.....	300 dozen women's machine-sewn medium, 20 dozen welted.
Collin, W., & Son.....	Castle St.....	100 dozen boys' machine-sewn medium.
Cooper, J. & Sons (Ltd.).....	Tudor Rd.....	500 dozen women's machine-sewn and welted.
Cooperative Wholesale Society (Ltd.).....	Wheatheaf Works.....	1,200 dozen women's and men's machine-sewn and welted.
Crick, T., & Co.....	Bedford St.....	300 dozen women's machine-sewn medium.
Daykin & Russell.....	Braunstone Gate.....	300 dozen women's machine-sewn medium.
Draycott, F. G. T.....	Victoria Shoe Works, Willow St.	120 dozen women's machine-sewn medium.
Dunkley & Wright.....	Western Rd.....	130 dozen women's machine-sewn medium.
Durrad, Swift & Co.....	Mill Lane.....	150 dozen girls' machine-sewn common.
Durston & Harby.....	14 Green Lane Rd.....	80 dozen nurseries machine-sewn common and 150 dozen children's machine-sewn common.
Elliott, J., & Sons.....	Oxendon St.....	80 dozen machine-sewn, 20 dozen welted.
Ellis, B. & Co.....	Clyde St.....	240 dozen machine-sewn, welted and turn shoes, medium, practically all women's.
Ellis, W. & E.....	Deacon St.....	250 dozen women's machine-sewn medium.
Evans, G., & Sons.....	Belgrave Rd.....	400 dozen women's machine-sewn.
Evans, Wm.....	Ashleigh Shoe Works.....	260 dozen machine-sewn, 100 dozen welted.
Fowler, W. S.....	114 Lower Brown St.....	120 dozen children's machine-sewn common.
Fox, W. E., & Co.....	Occupation Rd.....	250 dozen women's machine-sewn, and 30 dozen welted shoes.
Freeman, G., & Sons.....	Royal East St.....	60 dozen women's machine-sewn common.
Garner, D.....	26 Charles St.....	240 dozen women's, girls', and boys' machine-sewn.
Garner, F. W., & Partnership.....	Willow St.....	300 dozen women's machine-sewn common.
Garner, J., & Sons.....	91 Crafton St.....	450 dozen women's and boys' machine-sewn common.
Glover, J. & E.....	Lichfield St.....	500 dozen women's machine-sewn medium.
Goddard, T. & Co.....	Harold St., Aylestone Park.	100 dozen nurseries machine-sewn.
Green, G., & Sons.....	Ash St.....	1,000 dozen machine-sewn and welted.
Griffin, J. T., & Co.....	Potter St.....	120 dozen women's machine-sewn common.
Hincks & Saunders.....	Junior St.....	200 dozen children's machine-sewn medium.
Hartshorn & Jesson.....	Acorn St., Melton Rd.....	180 dozen women's machine-sewn medium.
Hanger, Chattaway & Smith.....	Western Rd.....	800 dozen women's machine-sewn and welted.
Harvey, Richardson & Co.....	Junior St.....	300 dozen girls' and boys' machine-sewn common.
Heiser Shoe Co.....	Nedham St.....	200 dozen women's welted.
Headley, Cox & Co.....	Forest Rd.....	300 dozen children's machine-sewn.
Holyoake & Brown.....	Mansfield St.....	200 dozen women's machine-sewn medium.
Hassell, G., & Sons.....	Freehold Shoe Works, Cobden St.	180 dozen women's and girls' machine-sewn common.
Harvey, H. C., & Sons.....	East Bond St.....	150 dozen women's machine-sewn medium.
Hatton, T., & Co.....	Briton St.....	80 dozen women's machine-sewn medium.
Howard & Hallam.....	Elmdale Works, Belgrave.	220 dozen women's machine-sewn.

Boot and shoe manufacturers—Continued.

ENGLAND—LEICESTER AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
LEICESTER—continued.		
Hunt, T. G.	Melton Rd.	400 dozen women's machine-sewn medium.
Henderson, D., & Sons.	St. Saviours Rd.	400 dozen machine-sewn and welted good.
Hill, W. L.	Belvoir Works, Bedford St.	80 dozen girls' and boys' machine-sewn medium.
Johnson, J., & Co.	Ash St.	280 dozen children's machine-sewn medium.
Jennings, W. A.	Moore's Rd., Belgrave	220 dozen, boys' machine-sewn medium.
Jennings, E., & Co.	Church Gate Works.	300 dozen women's machine-sewn medium.
Jones & Gamble.	Highcross St.	120 dozen children's machine-sewn common.
Kellett, E., & Co.	Baggrave St.	260 dozen boys' and girls' machine-sewn common.
Knight, Mobbs & Co.	Moore's Rd.	150 dozen boys' and girls' machine-sewn common.
Knight Bros. & Co.	Crown Hill Works, Elizabeth Rd.	600 dozen boys' and girls' machine-sewn common.
Kennell, F., & Co. (Ltd.).	Beatrice Rd.	240 dozen football and canvas machine-sewn.
Leicester C. C. Boot Co.	Guthlaxton St.	120 dozen women's and girls' machine-sewn medium.
Leavesley & North.	46 Humberstone Rd.	200 dozen welted and 900 dozen machine-sewn good.
Letts, A.	Rendall Rd.	160 dozen women's machine-sewn common and 200 dozen boys' and girls' machine-sewn common.
Lennard Bros (Ltd.).	Asylum St.	400 dozen machine-sewn and 100 dozen welted.
Leicester Cooperative Boot & Shoe Manufacturing Society (Ltd.).	Western Rd.	300 dozen machine-sewn and welted.
Leicester Self-Help Boot & Shoe Manufacturing Society (Ltd.).	Dartford Rd., Aylestone Rd.	150 dozen women's machine-sewn medium.
Law, J. J.	30½ Painter St.	180 dozen football machine-sewn.
Moore, W.	Excelsior Works, Ashfordby St.	250 dozen women's and children's machine-sewn.
Matthews, W. M.	Briton St.	300 dozen children's machine-sewn common.
Moore & Sproston.	7a Spinney Hill F-1	100 dozen children's machine-sewn medium.
Nichols, Son & Clow.	Nordgates.	400 dozen machine-sewn and welted.
Nixon, H., & Co.	155 Brunswick St.	80 dozen boys' and girls' machine-sewn common.
Peake, C. A.	Kanyon St.	100 dozen women's and girls' machine-sewn common.
Page & Potter.	Kings Newton St., St. Peters Rd.	180 dozen women's machine-sewn common.
Parker, F.	Ash St.	300 dozen boys' and girls' machine-sewn common.
Pickard, T. G., & Co.	Framland St.	280 dozen women's machine-sewn common.
Percival, J., & Co.	Rolleston St.	560 dozen girls' and football machine-sewn.
Pendleton, J. W.	Albert Works, Humbershire Rd.	500 dozen women's machine-sewn. 200 dozen veldtschoen.
Parker, J.	9 Spinner St.	150 dozen women's machine-sewn common.
Rawson, J., & Sons (Ltd.).	Evington Valley Rd.	450 dozen women's and girls' machine-sewn; 100 dozen welted.
Rowell, S.	Langton St. Works, Belgrave Gate.	250 dozen women's and girls' machine-sewn medium.
Roberts, T., & Sons.	Portland Shoe Works, The Newark.	350 dozen women's machine-sewn and welted.
Simpson, A. W., & Co.	Millstone Lane.	200 dozen women's machine-sewn medium.
Steed & Simpson.	Belgrave Gate.	500 dozen women's and girls' machine-sewn medium.
Smith, Faire & Co.	Park Vale Works, St. Saviours Rd.	500 dozen women's and girls' machine-sewn, 60 dozen welted.
Sutcliffe, J.	Aylestone Boot Works, Dartford Rd.	400 dozen women's and girls' machine-sewn medium.
Scannell, W. T., & Co.	Willow St.	200 dozen women's machine-sewn and welted.
Sowerbutts, J.	Stanley St.	120 dozen women's machine-sewn common.
Smith, W. J., & Co.	100 Baggrave St.	60 dozen boys' machine-sewn medium.
Sabin, J. A.	35 Wellford Rd.	160 dozen welted; 400 dozen women's machine sewn.
Thompson, W. A., & Co.	Eastern Boulevard.	100 dozen welted; 400 dozen women's machine sewn.
Tomlinson, W. H., & Co.	Bridge Rd.	350 dozen women's machine-sewn medium.
Tomkins, Spence & Co.	Mansfield St.	500 dozen women's machine-sewn medium.
Tompkins, Rowley & Co.	Blue Bear Lane.	50 dozen veldtschoen.
Tidd, W.	10 Flax Rd.	60 dozen boys' and girls' machine-sewn common.
Weston, H., & Co.	Halford St., Free Lane	200 dozen women's machine-sewn medium.
Ward Bros. & Co.	All Saints Rd.	120 dozen women's machine sewn.
Wheatley & Bagshaw.	Gladstone St.	300 dozen children's machine sewn.
Woolerton & Wilson.	Clyde St.	360 dozen women's machine-sewn medium, 50 dozen welted.
Ward, T. A.	50 Southgate St.	100 dozen children's machine-sewn common.
Wilkinson, W. H.	92 Dorset St., Belgrave Rd.	120 dozen children's machine-sewn medium.
Wright, G.	Samuel St.	200 dozen machine-sewn nurseries.
Williamson, J. W., & Co.	Yeoman St.	200 dozen women's machine-sewn medium.
Walker, Kampeon & Stevens.	Rutland St.	300 dozen women's and girls' machine-sewn best; 80 dozen welted.
		250 dozen machine-sewn canvas; 30 dozen turns.

Boot and shoe manufacturers—Continued.

ENGLAND—LEICESTER AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
LEICESTER—continued.		
Wilkes Bros. & Co.....	Reliance Works, Bruin St.	80 dozen welted, and 400 dozen women's and girls' machine-sewn.
Wilson, R., & Co.....	Woodboy St.	200 dozen women's machine sewn medium and welted.
Underwood, J., & Co.	Highcross St.	80 dozen women's and girls' machine-sewn common.
Yates, F. L.....	16 Fitzroy St.	120 dozen machine sewn nurseries.
Smith & Finney.....	28 Painter St. Belgrave Rd.	120 dozen children's machine sewn.
KEARL SHILTON.		
Abbott, A.....	West End Works.	200 dozen women's machine-sewn common.
Abbott, W. H.....	6 New St.	120 dozen women's machine-sewn common.
Arthur & Co.....		60 dozen women's and girls' machine-sewn common.
Bannister, A., & Co.		150 dozen women's and girls' machine-sewn common.
Bennett & Beeby.....		100 dozen women's machine-sewn common.
Bird, Bellamy & Co.		120 dozen women's machine-sewn common.
Green, Colver & Cobley.	Church St.	100 dozen women's and girls' machine-sewn common.
Grewcock, J.....	Church St. Works.	200 dozen children's machine-sewn common.
Hammonds & Co.....		80 dozen women's machine-sewn common.
Hurst, Cotton & Hopcroft.		400 dozen women's machine-sewn common and medium.
Loxley & Co.....		60 dozen women's and girls' machine-sewn common.
Norton, H. B.....	Keates Lane	80 dozen women's machine-sewn common.
Worthington, Bellamy & Co.		100 dozen women's and girls' machine sewn.
Whitmore, T., & Co.....	Hill Top Shoe Works.	200 dozen women's machine-sewn common.
BARWELL.		
Argyle, Grewcock & Ward.		300 dozen women's and girls' machine-sewn common.
Bennett & Co.....		300 dozen women's machine-sewn common.
Bonsor, G. B., & Co ..		400 dozen boys', girls', and women's machine-sewn common.
Garner, White & Breward.		400 dozen women's and girls' machine-sewn common.
Geary Bros.....		700 dozen women's and girls' machine-sewn common.
Hodgkin & Powers.....		150 dozen boys' and girls' machine-sewn common.
Harvey, Harvey & Co.		500 dozen women's and girls' machine-sewn common.
Moore, A., & Co.....	King St. Shoe Works	400 dozen women's machine-sewn common.
Ney Bros.....		200 dozen girls' machine-sewn common.
Smith, W.....		260 dozen women's machine-sewn common.
Sperope Boot Manufacturers (Ltd.).		150 dozen women's machine-sewn medium.
MELBOURNE.		
Coxons (Melbourne) (Ltd.).	Castle Square.....	300 dozen women's and girls' machine-sewn common.
Dunncliff Bros.....		100 dozen women's and girls' machine-sewn common.
Loake Bros.....		500 dozen women's and girls' machine sewn.
Parker, R.....	Wellington Boot Factory.	60 dozen children's and women's machine-sewn common.
Tivey & Andrews.....	West End Boot Factory.	200 dozen girls' machine-sewn common; 250 dozen women's and girls' machine-sewn medium.
Wilson, J., & Co.....		500 dozen women's and girls' machine-sewn common.
HINCKLEY.		
Callington, G. H., & Co.	John St.....	200 dozen women's machine-sewn common.
Harris, J., & Co.....	Factory Rd.	150 dozen women's machine-sewn medium.
Johnson, W., & Co. (Ltd.).		300 dozen women's machine-sewn medium.
Payne, A.....	Wood St.	180 dozen women's machine-sewn common.
Phillipot, Hawkins & Co.	Factory Rd.	150 dozen women's and girls' machine-sewn common.
Pick & Whitmore.....		250 dozen women's and girls' machine-sewn medium.
Toone Bros.....	Druid St.	300 dozen women's and girls' machine-sewn common.
NORTH EVINGTON.		
Cooperative Anchor.....		300 dozen girls' and women's machine-sewn common.
Durston, Geo.....	Lancaster St.	700 dozen girls' and boys' machine-sewn common.
Leeson, J., & Sons (Ltd.).	Albion Shoe Works.	350 dozen women's and football machine-sewn; 40 dozen welted.
Marlow, S., & Son.....	Brighton Rd. Works.	100 dozen children's machine-sewn medium.
Neal, J.....	Star Works, Dorothy Rd.	300 dozen nurseries' machine-sewn medium.

Boot and shoe manufacturers—Continued.

ENGLAND—LEICESTER AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
NORTH EVINGTON—CON.		
Palfreyman, F. J., & Co.	Dorothy Rd.	260 dozen women's and girls' machine-sewn; 100 dozen welted.
Sharpe, F., & Co.	Wood Hill.	200 dozen women's machine-sewn.
Stevenson, A.	Market Hall Square.	180 dozen women's machine-sewn common.
Thorpe, Wright & Co.	Baggrave St.	120 dozen women's machine-sewn common.
SILEBY.		
Bray, H. C.		240 dozen women's and girls' machine-sewn medium.
Excelsior Boot and Shoe Manufacturing Society (Ltd.)		100 dozen women's machine-sewn common.
Moir, J. W., & Co. (Ltd.)	Ratcliffe Rd.	300 dozen women's machine-sewn medium.
Swan & Preston.		250 dozen women's machine-sewn medium.
ANSTLEY.		
Palmer, G. H.	Anstley Boot Works.	1,000 dozen women's machine-sewn common.
Pollard, Boyes & Pollard.		500 dozen women's common.
Pickett, T.	Bridge Boot Works.	240 dozen women's machine-sewn common.
Springthorpe, Hunt & Co.		250 dozen women's machine-sewn common.
Smith, C., & Sons.		600 dozen women's machine-sewn common.
SOUTH WIGSTON.		
Black, J. W., & Co.	Eagle Works.	800 dozen women's machine-sewn medium.
Gamble, J., (Ltd.)	Stamford Shoe Works.	260 dozen women's machine-sewn common.
South Wigston Shoe Co.		240 dozen children's machine-sewn common.
Wright, O., & Sons.	Canal St.	450 dozen women's and girls' machine-sewn; 50 dozen women's welted.
BLABY.		
Beamish & Co.		300 dozen children's machine-sewn.
Turner, J., & Sons (Ltd.)	Havelock Boot Works.	250 dozen women's machine-sewn and welted.
OADBY.		
Clarke, M. M.		100 dozen women's and girls' machine-sewn common.
Denman, G. & T.		450 dozen children's machine-sewn common.
Ludlam & Co.	Spencer St. Works.	60 dozen women's and boys' machine-sewn common.
SYSTON.		
Garner, H., & Sons.		220 dozen children's machine-sewn.
Royce, D. C.		80 dozen women's and girls' machine-sewn common.
Rice, M. J., & Son.	Crown Sole Plate Boot Works.	500 dozen women's, boys' and football machine-sewn.
COSBY.		
Baraby, Tomlinson & Atkins.		400 dozen women's machine-sewn medium.
Starnes, S.	Croft Rd.	150 dozen boys' and girls' machine-sewn common.
Starnes, R.	Central Shoe Works.	100 dozen children's machine-sewn common.
Starnes, A.	3 Narborough Rd.	60 dozen women's machine-sewn common.
GLENFIELD.		
Glenfield Progress Co-operative Manufacturing System (Ltd.)		120 dozen women's and girls' machine-sewn common.
SHEPHERD.		
Green, G., & Sons.		400 dozen women's machine-sewn medium.
Green, H. F., & Sons.	Garendon Works.	300 dozen women's and girls' machine-sewn common.
ATHERSTONE.		
Atherstone Shoe Co.		400 dozen canvas and ward shoes, machine-sewn.
The Measham Shoe Co.	Measham.	300 dozen women's machine-sewn common.
DERRY.		
Clemson, J. (Ltd.)	Burton Rd.	400 dozen nurseries and girls', medium.
Hargreaves, Madsen & Ireland.	Bath St. Mills.	300 dozen women's and girls' machine-sewn.

Boot and shoe manufacturers—Continued.

ENGLAND—LEICESTER AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
ENDERBY.		
Cooperative Wholesale Society (Ltd.) Shoe Works.	.....	400 dozen women's machine-sewn.
Young, W.	King St.	120 dozen women's machine-sewn common.
MOUNTSORREL.		
Granite Boot Co. ....	.....	300 dozen boys' and football machine-sewn.
Wholesale Schoolboot Co.	.....	750 dozen boys' and girls' machine-sewn common.
OTHER PLACES.		
Mansfield Shoe Co.	Mansfield	350 dozen canvas and ward, machine-sewn.
Pick, J., & Co.	Victoria Rd., Whetstons.	500 dozen girls' and women's machine-sewn common.
Pym & Seymour (Ltd.)	284 Houndgate, Nottingham.	80 dozen girls' and women's machine-sewn medium.
Willett Bros.	Rothley	200 dozen nurseries machine-sewn.

ENGLAND—LEEDS AND DISTRICT.

LEEDS.		
Anglo-American School Boot Co.	99 Mabgate.	1,000 pairs boys' and youths' split and kip.
Appleson Morris.	Hope Sq., North St. ...	1,500 pairs slippers and ankle strap.
Bradley & Colley	Sheepscar Grove Shoe Factory.	500 pairs men's heavy.
Burn Bros.	40 Osmondthorpe Lane	1,000 pairs ankle straps and veldtschoen.
Burrell, Wm.	Mabgate Mills, Mabgate.	3,000 pairs ankle straps.
Daly & Sons.	Millgarth St.	400 pairs ankle straps.
Emerson, G. E.	Meanwood Rd.	1,000 pairs men's screwed and stitched.
Goldman, E., & Son.	23-24 Lady Lane.	2,000 pairs slippers.
Goodall, A.	Gibson St., Beckett St.	300 pairs men's heavy.
Gray, W., & J.	Elmwood Boot Factory, Camp Rd.	600 pairs men's, boys', and women's medium.
Green, H. & S.	Mill St., Marsh Lane..	800 pairs men's medium.
Green, J.	Ventnor Boot Factory, Ventnor St.	500 pairs men's heavy.
Green, R., & Son.	Burmantoft Boot Factory.	1,000 pairs women's good.
Landey, I.	1-3 Pollards Yard, Millgarth.	1,000 pairs slippers.
Mills, R., & Sons.	Dewsbury Rd.	1,200 pairs men's split, kip and box calf.
Malbourne Shoe Works.	Melbourne St.	1,000 pairs slippers.
Peel, T., & Co.	Jumbo Boot Factory, Kirkstall Rd.	1,000 pairs men's medium and good.
Public Benefit Boot Co. (Ltd.)	St. Paul's St.	1,500 pairs men's medium and good.
Phillips & Co.	Byron Mills.	1,000 pairs women's.
Percival, J., & Sons.	38 Marsh Lane.	1,000 pairs ankle strap.
Rhodes, F., & Co.	Steam Mills, Armley..	300 pairs screwed and stitched.
Salinsky, J.	The Excelsior Works, Lr. Brunswick St.	1,000 pairs women's ankle strap and common.
Wood, S. B.	Meanwood Rd.	200 pairs men's mixed.
Warren Bros.	99 Mabgate.	500 pairs women's ankle straps and common.
Wardle, T., & Son (Ltd.)	Benson St.	700 pairs men's screwed heavy and medium.
Walker, G. W.	York Bridge, New Mill, Duke St.	500 pairs men's medium.
Walker, H., & Sons (Ltd.)	Cardigan Boot Factory, Kirkstall Rd.	4,000 pairs men's heavy.
Winterbottom, Geo. (Ltd.)	St. Peter's Mills, York Rd.	1,000 pairs women's bar medium.
WATERFOOT.		
Barnes & Cronkshaw...	Atlas Slipper Works...	1,000 pairs slippers.
Bolton Bros.	Mill End Slipper Works.	2,000 pairs slippers.
Brooks, J. R.	Gordon Works.	1,500 pairs slippers.
Hardman, W., & Co.	Union Works.	3,000 pairs slippers.
Hardman Bros.	Orchard Works.	2,000 pairs slippers.
Haworth, J. H., & Co.	Warth Mill.	1,000 pairs slippers.
Howarth, L., & Sons...	Rosendale Slipper Works.	2,000 pairs slippers.

Boot and shoe manufacturers—Continued.

ENGLAND—LEEDS AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
WATERFOOT—contd.		
Hirst, J. H.	Whitewell Works.	10,000 pairs slippers.
Newchurch Boot Co.	Globe Works.	4,000 pairs slippers.
Ormerod & Co.	Vale Shoe Works.	1,500 pairs slippers.
Spencer & Johnson.	Spring Garden Works.	1,500 pairs slippers.
Trickett, J.	Green Bridge Works.	2,000 pairs slippers.
Trickett, H. W. (Ltd.).	.....	20,000 pairs slippers.
MANCHESTER.		
Feeney, F.	Victoria Works, Jubilee St., New Bridge St.	2,300 pairs slippers.
Gregg & Co. (Ltd.).	Imperial Works, Southall St.	3,000 pairs slippers and turns.
Jackson, H.	8 Duke St., Gravel Lane, Salford.	500 pairs slippers.
Kilby, W.	School St. Mill, Newton Heath.	2,000 pairs slippers.
Sutton, E.	32 Amber St.	300 pairs slippers.
STONEY MIDDLETON.		
Cocker, F. & A. ....	.....	400 pairs men's heavy.
Heginbotham Bros. ....	.....	Do.
Mason Bros. & Lennon. ....	.....	500 pairs men's heavy.
Nugent, J. & F. ....	.....	300 pairs men's heavy.
BACUP.		
Hargreaves, Maden & Ireland.	Waterside Mill.	1,500 pairs slippers.
McLerie, S., & Sons (Ltd.).	Grove Mill.	5,000 pairs slippers.
McLerie, J. J.	New Hey Mill.	6,000 pairs slippers.
GUISELEY.		
Cloughton, H u g h (Ltd.) ....	.....	3,000 pairs split and kip, common.
Watkinson, E., & Sons.	Hallamfield Mills.	500 pairs men's heavy and medium.
FRESTON.		
Berry, J., & Sons.	Hanover Mills, Kent St.	3,000 pairs slippers and veldtschoen.
Berry, Paul, & Sons.	Sundowner Mill.	1,500 pairs slippers and veldtschoen.
NEWCASTLE-ON-TYNE.		
Elkan, B.	42 Bayley St.	500 pairs slippers.
Fearson, L., & Co.	Gt. Bigg Market.	800 pairs slippers and men's, common.
ROCHDALE.		
Empress Slipper Works.	Boundary St.	2,000 pairs slippers.
Rochdale Slipper Co.	Oldham Road Mills.	1,000 pairs slippers.
FUDSEY.		
Scales & Sons (Ltd.).	Grove Works.	2,500 pairs men's best heavy and medium stitched.
Salter & Salter (Ltd.).	Allan Brigg Mills.	1,500 pairs men's best heavy and medium stitched.
HALIFAX.		
Seed Bros.	Akroyd Place, North Parade.	500 pairs men's heavy screwed and stitched.
Simpson & Blackburn (Ltd.).	Leafand St. Mills.	1,500 pairs slippers.
OTHER PLACES.		
Blackburn Shoe Factory (Ltd.).	Harley St., Blackburn.	600 pairs slippers and boots.
Bonner, B., & Sons.	Gladstone St., Staningley.	1,000 pairs men's stitched and welted medium.
Carruthers, C.	29 Ennerdale Rd., Cleator Moor.	500 pairs men's heavy.
Clegg, B.	Carr Mill, Stansfield Rd., Todmorton.	1,500 pairs slippers.

Boot and shoe manufacturers—Continued.

ENGLAND—LEEDS AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
OTHER PLACES—con.		
Cooperative Wholesale Society (Ltd.), Boot and Shoe Works.	Heckmondwike.....	5,000 pairs men's screwed, stitched, etc.
Dobson, Paul.....	Well Croft Mills, Shipley (Yorks.)	300 pairs men's and boys' medium.
Halliday, J., & Son....	Bramley.....	3,000 pairs men's heavy.
Murgatroyd, W. J.....	Cardigan St., Newtown.	1,500 pairs ward shoes.
Ridgeway, Fox & Slater	Town End, Eyam....	800 pairs ankle strap and bar.
West, E., & Sons.....	Eyam.....	1,500 pairs ankle strap and bar.
Ridgeway Bros.....	do.....	2,000 pairs ankle strap and bar.
Riley, J., & Sons.....	21-23 Sunbridge Rd., Bradford.	300 pairs men's screwed and stitched.
Rosen, C.....	33 Myton St., Hull....	500 pairs slippers.
Somervell Bros.....	Kendal.....	5,000 pairs men's best.
Stancilffe & Co. (Ltd.)..	Victoria Shoe Works, Woodman St., Hunslet.	3,000 pairs men's heavy and medium.
Webster Bros.....	Sudney St., Old Rd., Farnley.	200 pairs men's screwed and stitched medium.
Stacksteads Boot and Shoe Co. (Ltd.).....	Blackwood Mills, Stacksteads.	2,000 pairs slippers.
Yong, A., & Sons.....	Moorfield Works, Armley.	800 pairs men's screwed heavy and medium.

ENGLAND—LONDON AND DISTRICT.

LONDON.		
Adler, R.....	51 Hanbury St., Spitalfields, E.	3,000 pairs women's McKay-sewn, 1,000 pairs turns.
Barfield, A. E.....	4 The Grove, Mare St., N. E.	1,000 pairs girl's McKay-sewn, 2,500 pairs nurseries.
Barnes, H., & Co.....	67-69 Driffeld Rd., Old Ford, E.	700 pairs women's McKay-sewn.
Barratt, A. T., & Son..	59 Kenilworth Rd., Old Ford, E.	500 pairs McKay-sewn.
Bateman, R., & Son...	35-37 Mare St., Hackney, N. E.	100 pairs McKay-sewn, 180 pairs welts, 800 pairs turns.
Branch, J., & Son.....	236 Mile End Rd., E..	1,000 pairs McKay-sewn.
Branch, J., & Sons (Ltd.)	19-23 Bethnal Green Rd., E.	800 pairs turns.
Britten & Bannister...	335 Hackney Rd., N. E.	500 pairs McKay-sewn, 1,000 pairs turns.
Chissick & Kirchenstein.	Mile End Rd., E.....	3,500 pairs McKay-sewn, 1,200 pairs turns.
Colwell, W.....	6-12 Ash Grove, Mare St., Hackney, N. E.	3,500 pairs McKay-sewn.
Cooper, H., jr.....	Town Hall Shoe Works, Hackney, N. E.	500 pairs McKay-sewn, 1,000 pairs turns.
Cunnington, A.....	64 Well St., Hackney, N. E.	500 pairs women's McKay-sewn, 600 pairs women's turns.
Durston, F. J.....	9 and 11 London Lane, Mare St., Hackney, N. E.	1,200 pairs McKay-sewn.
Ellis Bros.....	East St., Walworth, S. E.	1,100 pairs McKay-sewn.
Flatau, A. & W., & Co.	The Hale, Tottenham.	2,500 pairs welts, 7,000 pairs McKay-sewn. ¹
Frank & Co.....	1 Silesia Buildings, Mare St., Hackney, N. E.	700 pairs children's McKay-sewn.
Franks, H.....	High St., Shadwell....	3,000 pairs women's McKay-sewn.
Franklin, J., & Sons...	58-62 White Lion St., E.	100 pairs welts, 700 pairs turns, 9,000 pairs McKay-sewn.
Fursee, J.....	51-53 Blahope Rd., Cambridge Heath.	150 pairs turns, 100 pairs welts, 400 pairs McKay-sewn.
Garnham, A. & J.....	Andrews Rd., Higham Hill, Walthamstow.	3,500 pairs McKay-sewn, 600 pairs turns.
Goodman, H., & Sons..	20 Columbia Rd., Hackney Rd., N. E.	600 pairs women's McKay-sewn.
Gould, D.....	31 Mare St., Hackney, N. E.	2,500 pairs slippers, 1,000 pairs turns.

¹ This firm also has 1,500 turns made outside the factory.

Boot and shoe manufacturers—Continued.

ENGLAND—LONDON AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
LONDON—continued.		
Greenwood, A.	Standard Boot Factory, 12 Upton Rd., N.E.	1,200 pairs McKay-sewn, 300 pairs turns.
Herring, F.	14 Cambridge Circus, Hackney Rd., N.E.	400 women's McKay-sewn.
Hartley & Barnes.	2 Ash Grove, Mare St., Hackney, N.E.	700 pairs women's McKay-sewn.
Jacobs & Bresslof.	Whitechapel Rd., E.	400 pairs McKay-sewn.
Knight, A., & Co.	122 Lansdown Rd., N.E.	3,500 pairs children's turned veldtschoen.
Kenner, M.	53 Hanbury St., Spitalfields, E.	3,000 pairs turns.
Knowles, W. (Ltd.)....	2 Exmouth Place, Mare St.	700 pairs women's McKay-sewn, 1,000 pairs turns.
Kaufman, H.	88 High St., St. George's, E.	2,000 pairs women's McKay-sewn.
Levin, H.	3 Silesia Buildings, Mare St., Hackney, N.E.	2,000 pairs women's McKay-sewn; 600 pairs turns.
Leon, A. & H., Bros. & Co.	15-19 Artillery Lane, Bishopsgate, E.	2,000 pairs women's McKay-sewn, 1,200 pairs turns.
Lewy, M. T.	Belsham Shoe Works, Morning Lane, Hackney, N.E.	3,000 pairs McKay-sewn, 400 pairs turns.
Minta, N.	41 Crispin St., Spitalfields, E.	900 pairs women's McKay-sewn.
Mindel & Co.	14 Casson St., Whitechapel, E.	3,700 pairs women's McKay-sewn, 500 pairs turns.
Morris, E., & Son.	30 Mile End Rd., E.	1,200 pairs McKay-sewn.
Pocock Bros.	235 Southwark Bridge Rd., S. E.	2,300 pairs McKay-sewn and riveted, 72 pairs welted.
Lazarus, M., & Co.	140-146 Cambridge Rd., Bethnal Green, N.E.	3,000 pairs McKay-sewn.
Pohl, H. C.	210 Mare St., Hackney, N. E.	1,500 pairs nurseries.
Peal & Co.	Jeddo Rd., Shepherds Bush, W.	400 pairs, all sorts.
Pickard, W.	96 Amherst Rd., Dalston, N. E.	700 pairs McKay-sewn.
Piper & Delange.	16 Shore Rd., Well St., Hackney, N. E.	1,500 pairs McKay-sewn, 350 pairs turns.
Petch & Co. (Ltd.)....	22-24 Cowper St., City Rd., E. C.	2,500 pairs turns.
Read, B. A.	54 Well St., N. E.	1,000 pairs McKay-sewn, 500 pairs turns.
Shea & Co.	Havelock Works, Well St., Hackney, N. E.	Do.
Solomons, R.	48 Brushfield St., E. C.	5,000 pairs women's McKay-sewn.
Smith, R.	60 Whitechapel Rd.	5,500 pairs women's McKay-sewn.
Smith, S.	22 Tullierie St., Hackney Rd., N. E.	230 pairs women's and boys' McKay-sewn.
Sutorial (Ltd.)....	70-74 London Rd., S.E.	170 pairs, all sorts.
Steinhart, J., & Sons.	Essex St., Cambridge Rd., N. E.	2,500 pairs women's McKay-sewn.
Weber, I., & Sons.	23 Leman St., Aldersgate.	4,000 pairs McKay-sewn.
Weber, E., & Sons.	103, 105 West St., Cambridge Rd., Mile End, E.	3,000 pairs women's McKay-sewn, 1,500 pairs turns.
Whyt, P., & Sons.	346-348 Bethnal Green Rd., N. E.	2,500 pairs McKay-sewn.
Warden & Thacker.	24 Forston St., Hoxton, N.	1,800 pairs women's McKay-sewn and turns.
Weber Bros. & Phillips.	West Rd., Tottenham, N.	9,000 pairs women's McKay-sewn, 7,000 pairs turns.
Young, G., & Co.	230 Globe Rd., E.	1,300 pairs girls' and women's McKay-sewn and riveted, 1,000 pairs nurseries.
Boiton, H.	4 Westgate St., Mare St., N. E.	1,200 pairs men's canvas shoes, and 300 pairs girls' canvas shoes.
Davidge, C.	Lensdowne Rd., N. E.	900 pairs women's McKay-sewn.
Cohen, A. & W.	55 Handbury St., N.	700 pairs McKay-sewn.
Hyams, L.	Bethnal Green Rd., N. E.	1,000 pairs McKay-sewn, 1,200 pairs turns.
Lehany, P.	Mare St., N. E.	450 pairs McKay-sewn, 400 pairs turns.
Katz, V.	Hanbury St., E.	3,000 pairs McKay-sewn.
Pickard & Jones.	Mentmore Terrace, N. E.	1,200 pairs children's McKay-sewn.

70 SHOE AND LEATHER TRADE IN THE UNITED KINGDOM.

Boot and shoe manufacturers—Continued.

ENGLAND—LONDON AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
CHESHAM (BUCKS.).		
Barnes, J., & Sons.....	71-79 Waterside.....	1,000 pairs McKay-sewn.
Hayes, J., & Son.....	Bellingdon Rd.....	2,200 pairs men's McKay-sewn.
Jennings, Darwell.....	46-48 Church St.....	1,000 pairs McKay-sewn.
Mitchell, T., & Sons.....	71 Church St.....	350 pairs McKay-sewn.
Newton, D.....	Townsend Rd.....	250 pairs McKay-sewn.
Newton, G. & R.....		700 pairs McKay-sewn.
Quelch & Co.....		1,000 pairs McKay-sewn.
Tom & Co.....		500 pairs McKay-sewn.
ST. ALBANS.		
Freshwater, J., & Co. (Ltd.).....	Grosvenor Rd.....	1,200 pairs McKay-sewn, 200 pairs welted, and 200 pairs turns.
Lee, E., & Son.....		3,000 pairs women's McKay-sewn.
LETTON.		
Green, H.....	Norington Rd.....	5,000 pairs McKay-sewn.
Martyn, A. G.....	Church Rd.....	Do.
Newall, W. H.....	Reliance Works, Beaumont Rd., High Rd.	4,000 pairs McKay-sewn.
MAIDSTONE.		
Randall, F. W., & Co..	"The Golden Boot" ..	300 pairs children's welted shoes, 144 pairs children's McKay-sewn, and 700 pairs nurseries.

ENGLAND—BRISTOL AND DISTRICT.

BRISTOL.		
Ashley, R. W., & Sons..	Portland Square.....	900 pairs women's light, 100 pairs heavy nailed.
Coe, Church & McPherson.	King Square.....	2,000 pairs women's and children's light.
Cridland & Rose.....	Dighton St.....	3,000 pairs women's light and army work.
Derham Bros. (Ltd.)...	Staple Hill.....	2,000 pairs women's and girls' light.
Flock & Sons.....	Portland Square.....	600 pairs women's light and heavy nailed.
Fussell, A., & Sons (Ltd.)	Kingswood Hill.....	1,000 pairs women's and men's light and nailed.
Headford, J., & Erwin..	Excelsior Boot Factory.	900 pairs women's and girls' best light.
Levi & Co.....	Pritchard St.....	1,000 pairs women's common light.
Mayo & Co.....	29 Portland Square...	1,400 pairs women's light.
Nash, G., & Sons (Ltd.)	16 Portland Square...	600 pairs women's light.
Orr & Pole.....	Brompton Place, Lower Ashley Rd.	500 pairs women's common.
Pratt, E. W., & Co.....	Kingswood Hill.....	5,000 pairs women's light and nailed.
Parsons & Co.....	Cliftonia Works, Gerish Avon, Whitehall.	2,000 pairs women's light.
Steadman, H., & Co....	Castle Green.....	3,000 pairs women's light.
KINGSWOOD.		
Bawn Bros.....	Moravian Rd.....	600 pairs men's nailed.
Bees & Potter.....		4,000 pairs men's nailed.
Britton & Sons.....		5,000 pairs heavy nailed.
Champion Boot Co.....		2,000 pairs heavy nailed.
Furber, H.....	Downend Rd.....	1,500 pairs men's nailed.
Hoare & Douglas.....		2,000 pairs men's heavy.
Johnson, A.....	Black Horse Rd.....	1,500 pairs men's nailed.
Jay Bros.....		3,000 pairs men's nailed.
Lovell, A., & Co.....	Challenge Boot Works.	2,000 pairs heavy nailed.
Miles, T., & Co. (Ltd.)		800 pairs men's nailed.
Moon, A. F., & Co.....		800 pairs men's nailed.
Pow, I., & Sons.....		5,000 pairs men's nailed.
Rudge, W. S.....	Hopewell Hills.....	1,500 pairs men's nailed.
Saunders Bros.....		5,000 pairs men's nailed.
Silverthorne & Child..		1,000 pairs men's nailed.
Savery, H., & Co.....		2,000 pairs men's nailed.
Wetton, J. W., & Co...		1,000 pairs men's nailed.
OTHER PLACES.		
Ashman Bros.....	Paulton.....	1,500 pairs men's nailed.
Butler, W. G.....	do.....	2,000 pairs heavy nailed.
Bryant, Geo., & Son...	St. George.....	5,000 pairs heavy nailed.

Boot and shoe manufacturers—Continued.

ENGLAND—BRISTOL AND DISTRICT—Continued.

Names of firms.	Addresses.	Weekly production and class of work.
OTHER PLACES—CON.		
Smith, R. C.....	Bryants Hill, St. George.	1,500 pairs men's nailed.
Clark, C. & J. (Ltd.)...	Street (Somerset).....	20,000 pairs women's and children's light.
Sadler & Lockhill Co. (Ltd.)	do.....	600 pairs women's light.
Cook, Geo.....	Anchor Works, Hanham.	1,500 pairs heavy nailed.
Empire Boot Manufacturing Co.	Waterloo Factory, Hanham.	2,000 pairs men's nailed.
Fry, S.....	High St., Oldlands.....	4,000 pairs men's nailed.
Needs, E., & Co.....	North St., Oldlands.....	1,500 pairs men's nailed.
Brain, T. W., & Co.....	North Common, Warmley.	4,000 pairs men's nailed.
Edwards, A., & Sons..	Midsomer Norton (near Bath).	4,000 pairs men's heavy.
Elston, J., & Sons.....	Crediton.....	1,200 pairs women's and men's medium.
Morgan Bros.....	Gwalla Works, Brynmawr.	1,600 pairs men's nailed.
Stevens, C. R.....	Avondale Boot Works, Chippenham.	800 pairs men's nailed.
Smith's Boot Manufacturing Co. (Ltd.)..	Cathedral Works, Redruth.	3,000 pairs men's heavy.
Woodington, J. H.....	Clevedon.....	5,000 pairs men's nailed.

ENGLAND—STAFFORD AND DISTRICT.

STAFFORD.		
Barton & Riley.....	St. Patrick's Place....	2,000 pairs McKay-sewn, 500 pairs welted.
Bostock, E., & Co. (Ltd.)	do.....	6,000 pairs McKay-sewn, 3,000 pairs welted.
Dyche, James.....	Marsh St.....	400 pairs McKay-sewn, 100 pairs welted.
Hollin, D., & Co. (Ltd.)..	Borough Works.....	2,000 pairs McKay-sewn, 500 pairs welted.
Johnson, S., & Son.....	North St.....	400 pairs McKay-sewn, 80 pairs welted.
Lloyd, Ebbert & Co.....	Royal Boot Factory...	500 pairs McKay-sewn, 200 pairs welted.
Mason & Marson (Ltd.)..	do.....	2,000 pairs McKay-sewn, 700 pairs welted.
Mottram & Sons.....	Marston Rd.....	600 pairs McKay-sewn, 80 pairs welted.
Peech, W. H., & Co. (Ltd.)	do.....	500 pairs McKay-sewn, 400 pairs welted.
Riley, C. H., & Sons.....	do.....	600 pairs McKay-sewn, 400 pairs welted.
Scott, J., & Co.....	Marsh St.....	1,200 pairs McKay-sewn, 600 pairs welted.
Ward, R. J.....	36 Rowley St.....	700 pairs McKay-sewn, 300 pairs welted.
Ward, W., & Son.....	Stafford Works.....	1,500 pairs McKay sewn, 500 pairs welted.
BIRMINGHAM.		
Fitchett, G.....	Thorpe St.....	1,200 pairs all sorts.
Green, S.....	157½ Bromsgrove St....	800 pairs slippers.
Shillcock, W., & Co.....	69 Newtown Row.....	1,000 pairs football boots, riveted and McKay-sewn.
Samuels, B.....	78 Hurst St.....	1,000 pairs slippers.
WOLVERHAMPTON.		
Baker, Jas., & Sons (Ltd.)	Cleveland Rd.....	4,600 pairs McKay-sewn, 400 pairs welted, and 2,000 pairs riveted.
Craddock Bros. (Ltd.)..	Powlett St.....	2,300 pairs McKay-sewn, 450 pairs welted.
Reed, G. & S.....	St. George's Parade....	900 pairs machine-sewn.
OTHER PLACES.		
Bostock, E., & Co. (Ltd.)	Stone (Staff.).....	2,500 pairs McKay-sewn, 2,500 pairs turns.
Stone Boot Manufacturers (Ltd.)	do.....	1,400 pairs McKay-sewn, 60 pairs welted, and 800 pairs veldtschoen.
Gilbert Bros.....	Nantwich.....	500 pairs McKay-sewn, 200 pairs welted.
Hobson, J.....	Barker St., Nantwich.	400 pairs McKay-sewn, 250 pairs welted.
Hampton Bros.....	Netherton (near Dudley).	700 pairs nailed work.
Macclesfield Shoe Co...	Sunderland St. Mills, Macclesfield.	6,500 pairs slippers.
Wynne, H.....	49 Tarvin St., Chester.	250 pairs turns.
Willis, J. F., (Ltd.).....	Wrooster.....	1,000 pairs McKay-sewn, 1,200 pairs welted.
Drury, V.....	Bromsgrove.....	3,000 pairs McKay-sewn, 2,300 pairs nailed.

Boot and shoe manufacturers—Continued.

ENGLAND—NORWICH AND DISTRICT.

Names of firms.	Address.	Weekly production and class of work.
NORWICH.		
Bowhill, Thos.....	Bridewell Alley.....	2,000 pairs McKay-sewn, 1,000 pairs veldtschoen, 1,000 pairs machine turns, 2,000 pairs hand turns.
Breed, G. W.....	13 Sussex St.....	400 pairs machine-sewn, 300 pairs veldtschoen.
Chittock, A., & Co.....	Eagle Shoe Works.....	1,000 pairs machine-sewn, 4,500 pairs machine turns, and 1,000 pairs veldtschoen.
Clarke, W. H. H. & Co.....	Ten Bell Lane.....	3,000 pairs machine-sewn, 3,000 pairs veldtschoen.
Edwards, W., & Sons.....	St. George's Plain.....	4,000 pairs machine-sewn, 4,000 pairs veldtschoen, 1,000 pairs machine turns, and 200 pairs hand turns.
Edwards & Holmes.....	Edelle Works.....	5,000 pairs machine-sewn, 3,000 pairs machine turns, and 4,000 pairs veldtschoen.
Gifford Bros.....	Pipebruners Yard, St. Benedicts.....	700 pairs veldtschoen.
Howlett & White (Ltd.).....	St. George's Plain.....	5,000 pairs machine-sewn, 4,000 pairs veldtschoen, 12,000 pairs machine turns, and 1,200 pairs welted.
Haldenstein, P., & Sons.....	.....	3,500 pairs machine-sewn, 1,500 pairs machine turns, and 1,000 pairs veldtschoen.
Holmes Bros.....	Starling Rd., Waterloo Rd.....	800 pairs machine-sewn, 1,200 pairs veldtschoen, and 2,000 pairs machine turns.
Harris, A., & Sons.....	3 Calvert St.....	1,000 pairs machine-sewn, 500 pairs veldtschoen, and 400 pairs machine turns.
Kirby, J. F.....	65 Pitt St.....	1,400 pairs machine-sewn.
Lee & Nickalls.....	119a Magdalen St.....	700 pairs veldtschoen.
Morgan Bros.....	Lower Westwick St.....	2,500 pairs machine-sewn, 80 pairs veldtschoen, and 3,500 pairs machine turns.
Sexton, H., & Sons (Ltd.).....	St. Edmunds Mills.....	6,500 pairs machine-sewn, 400 pairs veldtschoen, 6,000 pairs machine turns, and 600 pairs welted.
Southall, J., & Co.....	Chrome Rd.....	5,500 pairs machine-sewn, 4,000 pairs machine turns, 500 pairs welted, 2,000 pairs veldtschoen, 1,200 pairs hand turns.
Webster, W. C.....	Muspole St.....	1,500 pairs machine-sewn, 500 pairs machine turns, and 1,200 pairs veldtschoen.
Hale Bros.....	Lower Westwick St.....	1,000 pairs machine-sewn, 3,000 pairs hand turns, and 1,500 pairs veldtschoen.
Ramsbottom Bros.....	Calvert St.....	400 pairs machine-sewn, 1,000 pairs machine turns, and 800 pairs veldtschoen.
Whiteman & Ramsbottom.....	Fishergate.....	100 pairs machine-sewn, 700 pairs machine turns, and 1,000 pairs veldtschoen.
Seppings & Co.....	Cowgate St.....	200 pairs machine-sewn and 600 pairs veldtschoen.
IPSWICH.		
Britten & Son.....	Crown Works.....	400 pairs machine-sewn and 400 pairs machine turns.
Segger, F. R.....	Woodbridge Rd.....	500 pairs machine-sewn, 300 pairs veldtschoen, and 200 pairs machine turns.
Underwood & Son.....	.....	100 pairs machine-sewn and 300 pairs riveted.
COLCHESTER.		
Potter & Fisher.....	Priory St. Works.....	450 pairs machine-sewn and few pairs welted.

ENGLAND—KETTERING AND DISTRICT.

KETTERING.		
Allen & Caswell.....	Stamford Rd.....	1,200 pairs all grades.
Bird, T., & Sons.....	.....	4,000 pairs machine-sewn and welted.
Bryan & Son.....	Nelson Works.....	1,500 pairs machine-sewn and welted.
Cattell, Geo.....	Avenue Works.....	2,500 pairs screwed and stitched.
Chapman, H. J.....	Progressive Works, Lower St.....	1,000 pairs machine-sewn.
Chater & Son.....	King St. Works.....	1,200 pairs machine-sewn and welted.
Coe Bros.....	Old Netting Lane.....	1,000 pairs machine-sewn.
East, Chas.....	Britannia Works.....	4,000 pairs machine-sewn and welted.
Foster Bros. (Ltd.).....	Gladstone St.....	2,000 pairs machine-sewn and welted.
Gamble, S. E., & Sons.....	Rothwell.....	4,000 pairs welted.
Gravestock & Wright.....	Tresham Works.....	4,000 pairs machine-sewn and welted.
Humphrey, F.....	.....	1,400 pairs machine-sewn.
Hales, T.....	Avondale Rd.....	1,000 pairs machine-sewn and welted.
Huett, A. C.....	William St.....	1,200 pairs machine-sewn and welted.
James & Curtis.....	Bell Works, Victoria St.....	1,500 pairs machine-sewn and welted.
Kettering Cooperative Boot & Shoe Manufacturing Society.....	Havelock Works.....	2,000 pairs machine-sewn, common.
Kettering Boot & Shoe Manufacturing Co. (Ltd.).....	Albert St.....	8,000 pairs machine-sewn.
Loasby & Miller.....	Newland St.....	2,500 pairs machine-sewn.
Louke Bros. (Ltd.).....	Unique Boot Factory.....	4,000 pairs machine-sewn and welted.

Boot and shoe manufacturers—Continued.

ENGLAND—KETTERING AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
KETTERING—contd.		
Mumford & Co.	Nelson St.	1,500 pairs machine-sewn.
Mobbs Bros.	Northall St.	1,000 pairs machine-sewn and welted.
Nichols, W., & Son.	Regent St.	2,000 pairs army shoes.
Poulton, G. W.	Stamford Rd.	1,400 pairs machine-sewn and welted.
Rice & Co.	Gordon Works.	2,000 pairs machine-sewn and welted.
Spence, E., & Co.	Cobden Works.	800 pairs machine-sewn.
Smith, Sheffield & Foster.	Premier Works.	6,000 pairs machine-sewn and welted, good grade.
Thompson, M.	Carrington St.	1,000 pairs machine-sewn.
Timpson, W.	5 Market St.	3,000 pairs machine-sewn and welted.
Timpson, Bird & Smith	York Rd.	4,000 pairs machine-sewn and welted.
Wright Bros.	Havelock St.	2,000 pairs machine-sewn.
Wright, H., & Son.	Regent St.	3,000 pairs machine-sewn.
Wilson & Watson.	Avondale Works, Connaught St.	Do.
Wright, F., & Co.	Carey St.	4,000 pairs machine-sewn and welted.
Union Cooperative Society.	Regent St.	600 pairs machine-sewn.
RUSHDEN.		
Allebone, A.	Wellingborough Rd.	1,500 pairs machine-sewn and welted.
Bull, C. & Co.		1,000 pairs machine-sewn.
Cave, J., & Sons (Ltd.).		6,500 pairs machine-sewn, 1,000 pairs welted.
Childs, C.	2 Crabb St.	600 pairs machine-sewn.
Claridge, W.		2,400 pairs youths' machine-sewn.
Claridge, E., & Sons (Ltd.).		2,000 pairs machine-sewn.
Cooperative Wholesale Society (Ltd.).		5,000-6,000 pairs machine-sewn and screwed.
Crick & Patenall.		2,000 pairs machine-sewn.
Cunnington Bros.		2,200 pairs machine-sewn, 144 pairs welted.
Darlow & West.		1,200 pairs machine-sewn, 200 pairs welted.
Denton, B., & Sons.		1,500-1,800 pairs machine-sewn.
Groom, A., & Sons.		2,000 pairs machine-sewn and screwed.
Horrell, C. W.	Moore Rd.	4,000 pairs machine-sewn, 400 pairs welted.
Hyde, J. (Ltd.).		5,000 pairs machine-sewn.
Jacques & Clark.		6,000 pairs machine-sewn, 200 pairs welted.
Knight, F.	Park Rd.	2,000 pairs machine-sewn, 400 pairs welted.
Knight, J.	25-27 Victoria Rd.	2,600 pairs machine-sewn, 100 pairs welted.
Knight & Lawrence.	Manton Rd.	2,500 pairs machine-sewn.
Ladds, B.	Moor Rd.	1,200-1,500 pairs machine-sewn, 100 pairs welted.
Nurriah, Pallett & Co.	Shirley Park.	3,000 pairs machine-sewn, 400-500 pairs welted.
Robinson Bros.		2,000-2,500 pairs machine-sewn, 500 pairs welted.
Seelwood, S., & Co.	Harborough Rd.	3,000-4,000 pairs machine-sewn.
Sargent, W., & Co.		1,200-1,250 pairs machine-sewn, 200 pairs welted.
Sanders & Sanders.		1,500 pairs machine-sewn, 160 pairs welted.
Sargent, A., & Sons.	John St.	750 pairs machine-sewn.
Skeddes & Co.		1,200-1,400 pairs machine-sewn.
DESBOROUGH.		
Bosworth Bros. & Co.	Station Rd.	1,200 pairs men's and youths' common and medium.
Cheaney, J., & Son.		2,500 pairs men's and youths' common and medium.
Desborough Co-operative Society (Ltd.), I. & U. Works.		1,200 pairs men's and youths' machine-sewn, and 200 pairs welted.
Desborough Shoe Co. (Ltd.).	Queen St.	2,000 pairs men's and youths' machine-sewn.
Riley, B.		3,500 pairs men's and youths' common and medium, and 500 pairs welted.
Toone, B., & Co.		6,000 pairs women's machine-sewn, screwed, and pegged
WELLINGBOROUGH.		
Austin, L.	Wollaston.	5,000-6,000 pairs machine-sewn and screwed.
Foster, C. F., & Sons.	George St. Factory.	1,500 pairs mixed men's and youths' medium.
Gilbert, W. S.	Providence Buildings.	1,400 pairs mixed men's and youths' medium.
Glover Bros.	Grant Rd.	2,000 pairs mixed men's and youths' medium.
Hawkins, W., & Co.	Arthur St.	1,200 pairs mixed men's and youths' medium.
Midland Boot Manufacturers (Ltd.).	Blandford Works.	800 pairs mixed men's and youths' medium.
Northamptonshire Prod. Society.	Wollaston.	About 1,000 pairs machine-sewn and welted.
Phillips Bros.	do.	1,500-2,000 pairs machine-sewn.
Pitts, E. J.	High St., Wollaston.	1,500 pairs machine-sewn.
Page, F. W., & Co.	Guvnor Works, Palk Rd.	3,000 pairs mixed men's and youths' medium.
Partridge, A. W.	Wollaston.	800-1,000 pairs machine-sewn.
Rudlen, R., & Co. (Ltd.).	Mill Rd.	2,200 pairs mixed men's and youths' medium.

Boot and shoe manufacturers—Continued.

ENGLAND—KETTERING AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
WELLINGBOROUGH—continued.		
Shelton, W., & Sons...	Wollaston.....	500 pairs machine-sewn.
Sharman & Ekina.....	.....	1,000 pairs mixed men's and youths' medium.
Stanley Boot Co.....	.....	Do.
Sudborough Bros.....	National Works, Oxford St.	2,000 pairs mixed men's and youths' medium.
Tomlin, J., & Sons (Ltd.).	.....	1,500 pairs mixed men's and youths' medium.
Walker Bros.....	Mill Rd.	4,000 pairs mixed men's and youths' medium.
Wellingboro Boot and Shoe Manufacturing Society (Ltd.).	Herriott's Lane.....	1,500 pairs mixed men's and youths' medium.
Forsecutt, Z., & Sons...	Arthur St., Northampton Rd.	1,000 pairs mixed men's and youths' medium.
BOTHWELL.		
Avalon Boot Manufacturers (Ltd.).	Littlewood St.....	3,000 pairs machine-sewn and welted medium.
Butlin, J. T., & Son...	.....	2,000 pairs machine-sewn: few welted, heavy grades.
Chamberlain, C. W.....	.....	2,000 pairs machine-sewn, screwed, and a few welted.
Rothwell Boot and Shoe Co.	Stanley Works.....	2,000 pairs machine-sewn and welted.
Barjeant & Co. (Ltd.).	Crispin Works.....	1,500 pairs machine-sewn and welted.
BURTON LATIMER.		
Buckby Bros.....	Alexandra Works.....	1,500 pairs men's and youths' common to medium.
Whitney & Westley...	Latimer Works.....	6,000 pairs men's and youths' common to medium.
FINEDON.		
Bailey, A., & Son.....	.....	2,000 pairs common army bluchers (welted and machine-sewn).
Cooperative Boot and Shoe Society.	Obelisk Hill.....	1,000 pairs common army and navy (welted and machine-sewn).
Fox, J. H.....	Rock Works.....	800 pairs common army bluchers.
Minney, A. W.....	Tower Works.....	1,500 pairs common army bluchers.
Nutt, A., & Co. (Ltd.).	.....	1,800 pairs common army bluchers.
RAUNDS.		
Adams Bros.....	.....	About 5,000 pairs machine-sewn and welted.
Coggins, R., & Sons (Ltd.).	Nene Works.....	1,200-1,500 pairs machine-sewn and screwed.
Horrell, J., & Sons.....	.....	1,200-1,500 pairs machine-sewn.
Lawrence, W.....	.....	500 pairs machine-sewn.
Neal & Gates.....	.....	About 2,000 pairs machine-sewn.
Nicholls, C. E.....	Midland Works.....	About 1,200 pairs machine-sewn.
St. Crispine Prod. Society.	.....	1,500-2,000 pairs machine-sewn.
Smiths, O.....	.....	1,000 pairs machine-sewn.
Tebbutt & Hall Bros...	Coleman St.....	Do.
IRTHLINGBOROUGH.		
Horn, J. P., & Sons...	.....	2,000 pairs machine-sewn.
Lilley, T.....	.....	2,000 pairs machine-sewn, 160 pairs welted.
Parkins & Bird.....	.....	1,100 pairs machine-sewn and welted.
Shortland, J.....	Express Boot Works...	6,000 pairs machine-sewn.
Spencer, J., & Co. (Ltd.).	.....	2,500 pairs machine-sewn, 200 pairs welted.
BOKEAT.		
Drage, John, & Son...	.....	1,200 pairs machine-sewn and screwed, common.
Taylor, J. H.....	.....	700 pairs machine-sewn and screwed, common.
HIGHAM FERRERS.		
Parker, C.....	.....	6,000 pairs machine-sewn, 1,000 pairs welted.
Patenall, T.....	.....	500 pairs machine-sewn and welted.
Wright, A. E.....	.....	1,400-1,500 pairs machine-sewn, 144 pairs welted.
OTHER PLACES.		
Coles Boot Co.....	Burton Latimer.....	1,000 pairs men's and youths' machine-sewn, medium.
Denton & Cheaney.....	do.....	800 pairs men's and youths' machine-sewn, mixed.
Hodges, H.....	High St., Finedon.....	700 pairs common army bluchers.
Hawthorne, J. T.....	Finedon.....	1,200 pairs common army bluchers.
Knight, G.....	do.....	500 pairs common army bluchers.
Sudborough & Eady...	Burton Latimer.....	3,000 pairs men's and youths' machine-sewn, common to medium.

Boot and shoe manufacturers—Continued.

ENGLAND—NORTHAMPTON AND DISTRICT.

Names of firms.	Address.	Weekly production and class of work.
NORTHAMPTON.		
Allinson & Co.	Earl St.	500 pairs welted, 600 pairs machine-sewn.
Arnold, A. & W.	St. Giles Terrace	4,000 pairs welted.
Arnold Bros. & Co.	Henry St.	4,000 pairs machine-sewn and welted.
Beale & Co.	St. Michaels Rd.	500-600 pairs machine-sewn and welted.
Bostock, F.	Victoria St.	3,000 pairs machine-sewn and 4,000 welted.
Branch, John (Ltd.).	Henry St.	900 pairs machine-sewn and 1,500 pairs welted.
Branch, J., & Sons (Ltd.).	Kingsthorpe	3,000 pairs welted and 2,000 pairs machine-sewn.
Bridgewater & Co.	Defiance Boot Factory, Victoria Rd.	300-400 pairs welted and machine-sewn.
Broad Street Co. (Ltd.).		300 pairs welted and machine-sewn.
Chapman Bros.	St. Michaels Rd.	600 pairs machine-sewn and welted.
Church & Co.	Duke St.	3,500 pairs welted, 450 turns, 1,000 pairs machine sewn.
Collier, S. (Ltd.).	Harlestone Rd.	2,500-3,000 pairs welted and machine-sewn.
Crick & Co.	St. Giles St.	800 pairs machine-sewn, 1,200 pairs welted.
Crockett & Jones.	Perry St.	8,000 welted, 4,000 pairs machine-sewn, and 180 pairs hand-sewn.
Dawson, J., & Sons.	Overstone Rd.	1,800 pairs welted, 700 turns, 1,500 pairs machine-sewn.
Eales & Son.	Carey St.	500-600 pairs machine-sewn and welted.
Gainsford, J. H., & Co.	Hood St.	700-800 pairs machine-sewn and welted.
Gilbs, G., & Co.	Cyril St.	700 pairs welted and machine-sewn.
Holmes, J.	Ramblers Works, Clarke Rd.	Do.
Hornby & West.	Overstone Rd.	500 pairs welted and 1,000 pairs machine-sewn.
Hawkins, G. T.	Waukers Boot Factory.	6,000 pairs welted, 250 pairs machine-sewn.
Lewis, C. & E.	St. James End	16,000 pairs machine-sewn and welted.
Lee, A.	Kingsthorpe	2,400 pairs welted, 1,000 pairs machine-sewn.
Marks, W. J.	Regent St.	300 pairs machine-sewn.
Morris Bros.	Wycliffe Rd.	1,800 pairs welted, 500 pairs machine-sewn.
Manfield & Sons.		6,000 pairs welted, 3,000 pairs machine-sewn, 1,500 turns and hand-sewn.
Mounts Factory Co.		700 pairs machine-sewn and welted.
Morton, G. & W.	Perfecta Factory, Adnitt Rd.	1,000 pairs machine-sewn and welted.
Marlow, A. E.	St. James Works.	4,000 pairs welted, 3,000 pairs machine-sewn.
Marlow, J., & Sons (Ltd.).	St. Georges St.	6,000 pairs machine-sewn and welted.
Oakeshott & Finemore.	Talbot Rd.	2,000 pairs welted, 1,000-1,500 pairs machine-sewn.
Panther, F. W.	Barry Rd.	200 pairs welted and 880 pairs machine-sewn.
Pollard & Son.	St. Michaels Rd.	700 pairs welted and machine-sewn.
Padmore & Barnes (Ltd.).	Moccasin Works.	4,000 pairs welted, 2,000 pairs machine-sewn.
Robinson, J.	Spencer Factory	3,000 pairs machine-sewn and welted.
Randall, H. E. (Ltd.).	Ladys Lane.	2,000 pairs welted, 190 pairs hand-sewn.
Roe, J., & G. H.	Free School St.	1,400 pairs welted and 600 pairs machine-sewn.
Read, J., & W.	Billington St.	900-1,000 pairs machine-sewn and welted.
Sears, J., & Co.	Trueform Boot Factory.	9,500 pairs welted, 2,000 pairs machine-sewn.
Swan, G.	Brockton St.	2,500 pairs welted, 1,800 pairs machine-sewn.
Sharman, H., & Son.	Shakespeare St.	800 pairs machine-sewn and 2,400 pairs welted.
Singlehurst & Gulliver.	Kingsley Park	900 pairs welted, 200 pairs machine-sewn.
Stead & Simpson.	Ash St.	
Stevens, W. B., & Co.	St. Andrews St.	600 pairs welted, 400 pairs machine-sewn.
Tebbutt, G. M., & Sons.	Clare St.	1,000 pairs welted, 400 pairs machine-sewn, 600 turns and hand-sewn.
Tysoe, Green & Co.	7 and 9 Burns St.	500 pairs machine-sewn and welted.
Tompkins & Son.	Pythley St.	300 pairs awreries, and 100 pairs men's machine-sewn.
Tebbutt, F. T., & Co.	Nobility Boot Factory	800 pairs machine-sewn and welted.
Taylor, R., & Son.	Victoria Shoe Factory, Kettering Rd.	1,300 pairs welted and machine-sewn.
White, C. W., & Co.	Bath St.	300 pairs machine-sewn.
EARLS BARTON.		
Allebone, A.		600 pairs hand-welted and machine-sewn.
Barker, A., & Sons.		1,500 pairs machine-sewn and 700-800 pairs welted.
Brookes, W. J.	Cambria Boot Factory	500-600 pairs machine-sewn and fair-stitched.
Dunkley, A. W.	London End	250 pairs machine-sewn.
Dunkley, C., & Son (Ltd.).	Earls Barton	100 pairs welted and 1,900 pairs machine-sewn.
Knight, E.	do	1,200 pairs machine-sewn.
White & Co.	Progress Works.	3,000 pairs machine-sewn, 120 pairs welted.
Ward & Sheffield.		600 pairs machine-sewn, screwed, and fair-stitched.

Boot and shoe manufacturers—Continued.

ENGLAND—NORTHAMPTON AND DISTRICT—Continued.

Names of firms.	Address.	Weekly production and class of work.
OLNEY.		
Cowley, S., & Co.		1,500 pairs machine-sewn and riveted.
Hinde & Mann.	Cowper Factory.	5,400 pairs machine-sewn and fair-stitched, and 600 pairs welted.
Johnson, T.		400 pairs machine-sewn and screwed.
DAVENTRY.		
Mountain, F. W., & Daniels.	1 Waterloo.	1,900 pairs machine-stitched.
Rodhouse, C., & Son.	38 Oxford St.	3,000 pairs machine-stitched.
Stead & Simpson (Ltd.).		4,000 pairs machine-sewn, 900 pairs welted.
LONG BUCKBY.		
Cook, F.	South Place Shoe Works.	2,500 pairs welted, 250 pairs hand-sewn, 70-80 pairs machine-sewn.

SCOTLAND.

G. B. Croall.	James St., Bridgeton, Glasgow.	400 pairs welted and McKay-sewn.
R. & J. Dick (Ltd.).	Greenhead Works, Glasgow.	1,800 pairs McKay-sewn and Standard-screwed.
Fletcher & Glass.	146 London St., Glasgow.	900 pairs McKay-sewn slippers.
S. Gallery & Sons.	28 Landressey St., Glasgow.	6,000 pairs McKay-sewn.
Scottish Cooperative Society (Ltd.).	Shieldhall, Govan, Glasgow.	3,000 pairs welted, 9,000 pairs McKay-sewn, 3,000 riveted and screwed.
A. I. Scott & Son.	96 David St., Glasgow.	1,500 pairs welted, 200 McKay-sewn.
A. Strachan & Co.	177 Reid St., Bridgeton, Glasgow.	400 pairs McKay-sewn slippers.
J. & H. Dick.	Ladyland Shoe Factory, Maybole.	150 pairs McKay-sewn and Standard-screwed.
R. Crawford.	Maybole.	3,500 pairs, riveted and Standard-screwed.
J. Lees & Co.	Townend Shoe Factory, Maybole.	100 pairs welted, 2,000 pairs McKay-sewn, and 2,000 pairs riveted and screwed.
Saxone Shoe Co.	Titchfield Factory, Kilmarnock.	5,000 pairs men's high-class welted.
A. Cuthbert & Son.	Newton Leather Works, Ayr.	1,000 pairs McKay-sewn and Standard-screwed.
A. Lees.	St. Crispin's Works, Ayr.	200 pairs McKay-sewn and 1,400 pairs riveted and screwed.
Allan Bros.	Watson Crescent, Edinburgh.	900 pairs principally welted.
W. G. Craig.	193 George St., Aberdeen.	250 pairs riveted and Standard-screwed.
L. Morrison.	Spey Boot Works, Aberdeen.	150 pairs welted, 300 pairs McKay-sewn.
J. Angus.	Aberdeen.	100 pairs Standard-screwed.
R. Eadie & Son.	Blackford.	200 pairs Standard-screwed.
J. M. Taylor.	do.	1,000 pairs Standard-screwed and McKay-sewn.
S. Fairweather & Sons.	Abbey Works, Arbroath.	1,500 pairs welted, 1,500 pairs McKay-sewn, 600 pairs riveted and screwed.
C. Grant.	Arbroath.	400 pairs welted and 1,000 pairs riveted and screwed.
Forbes Boot Manufacturing Co.	Forres.	350 pairs McKay-sewn and Standard-screwed.
A. M. Meek & Sons.	162 High St., Linlithgow.	400 pairs Standard-screwed.
A. Morrison & Sons.	Linlithgow.	700 pairs Standard-screwed and riveted.
J. Mull & Sons.	Primrose Shoe Works, Leith.	700 pairs Standard-screwed and McKay-sewn.
Scroggle Bros.	Dalhousie Leather Works, Carnoustie.	300 pairs welted, 600 pairs McKay-sewn, 400 riveted and screwed.
J. Winter & Sons.	Carnoustie.	700 pairs welted, 100 pairs McKay-sewn, 200 riveted and screwed.
Maclaren Bros.	Ellon Bank Works, Ellon.	300 pairs McKay-sewn and Standard-screwed.
J. Watson.	Strathclyde Boot Factory, Carlisle.	1,800 pairs McKay-sewn and Standard-screwed.
W. & J. Young.	Laurieston, Falkirk.	800 pairs McKay-sewn and Standard-screwed.
A. T. Hogg.	Strathmiglo, Fife.	120 pairs McKay-sewn and Standard-screwed.
Arnott & Son.	Huntly.	600 pairs McKay-sewn and Standard-screwed.
Russell & Sons.	Portsoy.	300 pairs Standard-screwed.
P. Irvine.	Keith.	150 pairs Standard-screwed.
Kellie & Co.	Kilmaurs.	700 pairs welted, 1,500 pairs riveted and screwed.

Boot and shoe manufacturers—Continued.

IRELAND.

Names of firms.	Address.	Weekly production and class of work.
R. Beverland.....	70 Bridge End, Belfast.	300 pairs screwed, nailed, and pegged.
Williamson Bros. (Ltd.)	46 Royal Ave., Belfast.	700 pairs screwed, nailed, and pegged, and 100 pairs welted.
J. Winstanley.....	Irish Boot Factory, Dublin.	2,250 pairs screwed, nailed, and pegged, and 250 pairs welted.
Horne & Cahill.....	15 Broad St., Waterford.	100 pairs welted and 900 pairs nailed and McKay-sewn.
Lee Boot Manufacturing Co. (Ltd.)	Cork.....	300 pairs welted, 3,200 pairs nailed, screwed, McKay-sewn, and pegged.
J. E. Marlyn.....	Carrigan North, Sligo.	100 pairs nailed, and pegged.
William Clark.....	High St., Ballymena.	600 pairs nailed, pegged, and screwed.
M. Governey.....	Catherlough Castle Boot Factory, Carlow.	1,100 pairs nailed, pegged, and screwed.
J. Harper.....	Fountain Hill Tannery, Londonderry.	500 pairs nailed, pegged, and screwed.

HEAVY-LEATHER TANNERS.

ENGLAND—LIVERPOOL, MANCHESTER, AND DISTRICT.

Names of firms.	Address.	Description of trade.
City Tannery (Ltd.).....	31 Blackstock St., Liverpool.....	Sole-leather tanners.
Pitts, George, & Sons (Ltd.)	Kirkdale, Liverpool.....	Do.
J. Shakerly & Co.....	Bevington Bush, Liverpool.....	Do.
Vauxhall Tanning Co. (Ltd.)	Vauxhall Rd., Liverpool.....	Do.
British Leather Co. (Ltd.)	Trammere, Birkenhead.....	Dressing and split-hide tanners and curriers.
Robert Mellor (Ltd.).....	Fallsworth, Manchester.....	Sole-leather tanner.
S. Yarwood & Son (Ltd.)	Miles Platting, Manchester.....	Tanners and curriers.
John H. Fleming & Co. (Ltd.)	Fennel St., Warrington.....	Sole-leather and butts tanner.
Grappenhall Tannery Co. (Ltd.)	Grappenhall, Warrington.....	Sole-leather tanners.
Guest Bros. (Ltd.).....	Winwick St., Warrington.....	Do.
J. Hutchings.....	Howley Tannery, Warrington.....	Do.
William Mortimer & Co. (Ltd.)	Orford Tannery, Warrington.....	Sole-leather and rough-strap butt tanners.
Penketh Tanning Co. (Ltd.)	Penketh, Warrington.....	Sole-leather tanners.
Randall Bros. (Ltd.).....	Tanners Lane, Warrington.....	Do.
Wm. Reynolds & Co. (Ltd.)	Mersey, Warrington.....	Do.
Union Tanneries (Ltd.).....	Holmesfield Tannery, Warrington.	Do.
Vernon Street Tanning Co.	Vernon St., Warrington.....	Do.
A. Waring & Co. (Ltd.).....	Winwick St., Warrington.....	Tanners and tanners' waste merchants.
Warrington Tanning Co.	Mersey St., Warrington.....	Sole-leather tanners.
Astmoor Tanning Co.	Astmoor Tannery, Runcorn.....	Do.
Highfield Tanning Co. (Ltd.)	Runcorn.....	Do.
John Ockleston & Son.....	do.....	Tanners and curriers.
Booth Tanning Co. (Ltd.)	Litherland Rd., Bootles.....	Sole-leather tanners.
Northern Tanning Co. (Ltd.)	Hawthorne Rd., Bootles.....	Do.
Liverpool Tanning Co. (Ltd.)	Litherland.....	Do.
Walker (Ltd.).....	do.....	Do.
Parkinsons, Latchford (Ltd.)	Latchford.....	Do.
Silvanus Reynolds & Co. (Ltd.)	do.....	Do.
T. S. & D. Evans.....	Oswestry.....	Do.
Harvey & Sons (Ltd.).....	Peel Tannery, Bury.....	Tanners and curriers.
Hill Bros.....	Tooe Island Works, York.....	Do.
Randall & Porter (Ltd.).....	Low Mill Tannery, Ulverston.....	Sole-leather tanners.
William Walker & Sons (Ltd.)	Rosehill Tannery, Bolton.....	Sole-leather and strap-butt tanners.
William Walker.....	Whitehaven.....	Sole-leather tanner.
William Long & Son.....	Grappenhall.....	Do.
W. Story.....	Wigton, Cumberland.....	Sole-leather and strap-butt tanner.
J. Williamson & Son.....	The Tannery, Maryport.....	Strap butts, bends, and harness backs.

Heavy-leather tanners—Continued.

ENGLAND—LEEDS AND DISTRICT.

Names of firms.	Address.	Description of trade.
Wm. Beckworth & Sons (Ltd.).....	Viaduct Tannery, Leeds.....	Tanners and curriers.
Joseph Conyers & Sons (Ltd.).....	Kirkstall, Leeds.....	Do.
Dixon Bros.....	Kirkstall Road, Leeds.....	Do.
William Paul (Ltd.).....	do.....	Do.
W. L. Jackson & Sons (Ltd.).....	Buslingthorpe, Leeds.....	Do.
J. J. Flitch & Son.....	do.....	Calf and sole-leather tanners.
J. S. Stocks & Co.....	do.....	Sole-leather tanners.
Harold Nicholls.....	Leeds.....	Do.
W. L. Ingle (Ltd.).....	Millshaw Works, Churwell, Leeds.....	Tanners and curriers.
W. & H. Miers (Ltd.).....	Beeston, Leeds.....	Chrome calf and hide.
John White & Sons (Ltd.).....	Park Road Tannery, Bingley.....	Tanners and curriers.
Thackray & Sons.....	Newlay.....	Do.
Thos. Holmes & Sons (Ltd.).....	Anlaby Road, Hull.....	Do.
Hodgson & Sons (Ltd.).....	Beverly.....	Do.
R. & F. Harrison.....	Stepney, Newcastle-on-Tyne.....	Hide and sealakin tanners.

ENGLAND—LONDON AND DISTRICT.

John Dixon Sons & Taylor.....	Market St., Bermondsey, London.....	Dressing leather.
Edwin Ellis & Co. (Ltd.).....	Herney Lane, Bermondsey, London.....	Sole-leather tanners.
Palmer, Oastler & Co. (Ltd.).....	Market St., Bermondsey, London.....	Do.
M. Cozens & Sons.....	Walsall.....	Tanners and curriers.
E. T. Holden & Son.....	do.....	Do.
Oak Tanning Co. (Ltd.).....	do.....	Sole-leather tanners.
Handford, Greatorex & Co. (Ltd.).....	do.....	Tanners and curriers.
Stokes & Co.....	Hatherton St., Walsall.....	Sole leather and dressing leather.
William Beacall.....	Severn Tannery, Bewdley.....	Sole-leather tannery.
J. J. Williamson & Sons.....	St. Mildred's Tannery, Canterbury.....	Sole and calf leather tanners.
T. & H. Wilks.....	The Tannery, Kingston.....	Sole-leather tanners.
A. M. Dorman & Co.....	Maldstone.....	Do.
G. Muscott & Son.....	South Yardley.....	Do.
Hepburn & Co. (Ltd.).....	Prory Works, Dartford.....	Do.
Thomas Rea & Sons.....	Godalming, Surrey.....	Do.
Samuel Scott & Co.....	Stratford.....	Do.
E. & H. Sharland.....	Fareham, Hants.....	Do.
W. & A. J. Turner (Ltd.).....	Bramford Rd., Ipswich.....	Sole leather, harness, and dressing leather.
J. Whitmore & Son.....	Waveney Tannery, Beccles, Suffolk.....	Sole-leather tanners.
Whitmores (Ltd.).....	Eden Bridge, Kent.....	Do.
T. Day & Co.....	Kenilworth, Warwickshire.....	Do.

ENGLAND—BRISTOL AND WEST OF ENGLAND.

J. Cox & Co.....	Bedminster, Bristol.....	Sole-leather tanners.
Densham & Sons (Ltd.).....	Redcross St., Bristol.....	Do.
P. & S. Evans & Co. (Ltd.).....	Avondale, Bristol.....	Do.
Hassell & Cogan.....	Pennywell Rd., Bristol.....	Dressing-hide tanners.
Hamlyn Bros.....	Buckfastleigh, Bristol.....	Sole-leather tanners.
Parker Bros. (Ltd.).....	Whitahouse St., Bristol.....	Do.
T. Ware & Sons (Ltd.).....	Clift House Tannery, Bristol.....	Do.
Western Tanning Co.....	Bedminster, Bristol.....	Do.
Sellwood Bros.....	East View, Cullompton.....	Do.
Jas. Cock & Sons.....	Shrewsbury.....	Do.
J. Sliderrin & Co.....	Minehead.....	Do.
Tremlett Bros.....	Exeter.....	Do.
J. Vicary & Sons.....	Newton Abbot.....	Do.

SCOTLAND.

The Millar Tanning Co. (Ltd.).....	Lady Well Tannery, Maybole.....	Sole and harness leather tanners.
James Ramsay & Co. (Ltd.).....	St. Cuthbert's Tannery, Maybole.....	Do.
The Dumfries Tanning Co. (Ltd.).....	Shakespeare St., Dumfries.....	Sole-leather tanners.
The Eglington Chrome Tanning Co. (Ltd.).....	8 Fairhill Rd., Glasgow.....	Sole-leather and belting tanners.
Alex. Hardie & Sons.....	232 High St., Linlithgow.....	Sole-leather and dressing-leather tanners.
J. B. Thomas & Co.....	Rivalds Green, Linlithgow.....	Sole-leather and harness-leather tanners.
John Muir & Sons.....	Bath Lane, Belth.....	Pigskin and dressing-leather tanners.
E. T. Holden & Son.....	Bathwell Tannery, Belth.....	Do.

Heavy-leather tanners—Continued.

SCOTLAND—Continued.

Names of firms.	Address.	Description of trade.
W. J. & H. Lang.....	Whitehead Tannery, Paisley....	Sole-leather and dressing-leather tanners.
R. & H. Baird.....	Falkirk.....	Do.
D. Callender & Sons.....	Bonnington Tannery, Leith.....	Sole-leather tanners.
The Gryffe Tannery Co.....	Bridge of Weir.....	Pigskin and dressing-leather tanners.
George Honeyman & Sons.....	Strathmore Tannery, Coupar Angus.....	Sole and harness leather tanners.
The Beaver Tanning Co. (Ltd.).....	Beaverbank, Edinburgh.....	Sole-leather tanners.
Thomas Lyon & Son.....	Millgate Tanworks, Arbroath.....	Do.

IRELAND.

John Atkins.....	Dunmanway, County Cork.....	Harness-leather tanner.
Peter Cullen.....	Ballytors.....	Harness and sole leather tanner.
R. Crean.....	Chonmel.....	Do.
Dunn Bros.....	Watercourse Road, Cork.....	Sole-leather tanners.
E. O'Callaghan & Son.....	City Tannery, Limerick.....	Sole and harness leather tanners.
Thomas Jones & Co.....	New Ross.....	Do.
James Harper.....	Fountain Hill Tannery, Londonderry.....	Harness-leather tanner.
M. Hardy & Son.....	Richill, County Armagh.....	Do.
John Ryan, sr.....	Church St., Thomastown.....	Do.
Ryan & Son.....	Thomastown.....	Do.
Williamson Bros. (Ltd.).....	46 Royal Ave., Belfast.....	Do.

LIGHT LEATHER TANNERS AND MANUFACTURERS.

ENGLAND.

Names of firms.	Address.	Description of trade.
J. Beach & Sons (Ltd.).....	53 Bermondsey St., London.....	Chamois-leather dressers.
Beringtons & Sons.....	St. Thomas St., London.....	Tanners and manufacturers.
F. Braybrooks & Co. (Ltd.).....	Tyers Gateway, London.....	Leather manufacturers.
J. S. Deed & Sons (Ltd.).....	91 New Oxford St., London.....	Do.
Dunn Bros.....	Tanner St., London.....	Do.
East, Kinsey & East.....	Bermondsey St., London.....	Do.
Richard Fawsitt.....	Tower Bridge Rd., London.....	Chrome leather and glazed calf manufacturer.
J. Garner & Sons.....	The Grange, Bermondsey, London.....	Skiver and fancy leather manufacturers.
G. Gibbs & Sons.....	29 St. Brides St., London.....	Fancy leather dressers.
Nickerson Bros.....	99 Worship St., London.....	Morocco, roan, skivers, and fancy leathers.
R. & J. Pullman (Ltd.).....	17 Greek St., Soho, London.....	Leather dressers.
Tebbutt Bros.....	40 St. Thomas St., London.....	Leather manufacturers.
G. Whicelow.....	82 Tanner St., London.....	Tanner and glazed kid manufacturer.
British Chrome Tanning Co. (Ltd.).....	St. Andrews Tannery, Northampton.....	Skiver-leather tanners.
J. Collier & Co.....	Dunster St., Northampton.....	Leather manufacturers.
W. E. & J. Pebody (Ltd.).....	Lower Mounts, Northampton.....	Chrome tanners and manufacturers.
Petit & Sons.....	Monks Pond St., Northampton.....	Chrome tanners and fancy leather manufacturers.
Horsfield, Son & Mackrell Bros. (Ltd.).....	Meanwood Rd., Leeds.....	Fancy leather manufacturers.
J. J. Fitch & Son.....	Buslingthorpe, Leeds.....	Calf tanner and fancy leather manufacturer.
J. S. Stocks & Co.....	do.....	Fancy leather manufacturers.
W. & H. Miers (Ltd.).....	Beeston, Leeds.....	Chrome calf tanners and fancy leather dressers.
Wm. Lawson & Sons.....	Otley, Leeds.....	Leather manufacturers.
T. Bayley & Co. (Ltd.).....	Lenton, Nottingham.....	Leather dressers.
Turney Bros. (Ltd.).....	Trent Bridge Leather Works, Nottingham.....	Sheep and fancy leather manufacturers.
Wade & Co.....	Whitmoor, Nottingham.....	Chrome, chamois, crust, and finished skivers.
W. H. Staynes & Smith.....	Frog Island Tannery, Leicester.....	Real and mock buck and doe, chamois, and lamb.
A. G. Jones & Co. (Ltd.).....	Slack Lane, Derby.....	Splitts, fashes, roans, and chamois.
W. & J. Richardson.....	Eagle Leather Works, Derby.....	Tanners and curriers.
Amos Davies.....	Audenshaw, near Manchester.....	Hat-leather dresser.
Robert Noblett.....	do.....	Tanner and leather dresser.

Light leather tanners and manufacturers—Continued.

ENGLAND—Continued.

Names of firms.	Address.	Description of trade.
J. Ormerod & Sons (Ltd.).....	Castleton, near Manchester.....	Belting, roller skins, buffalo, and leather pickers.
W. & J. Sager.....	Ball Grove, Colne, Lancashire..	Splits, skivers, sheepskin, grains, fleeces, etc.
Saml. Smith & Sons.....	do.....	Grains, fleeces, roans, roller skins, and skivers.
J. & T. Beaven.....	Holt, Wilts.....	Fellmongers and leather dressers.
H. Beebe & Co.....	Park St., Walsall.....	Tanners, curriers, and leather manufacturers.
B. Cannon & Co. (Ltd.).....	Lincoln.....	Light leather manufacturers.
Charles Case & Son.....	Frome, Somerset.....	Chrome glazed kid manufacturers.
N. G. & M. Chapple.....	Torrington, Devon.....	Chamois and skiver dressers.
F. Cocker, jr. (Ltd.).....	Brinksway Leather Works, Stockport.....	Hat leather manufacturers.
T. Ensor & Sons.....	Milbourne Port, Somerset.....	Leather dressers.
Percy E. Fisher.....	Godalming, Surrey.....	Light leather manufacturer.
J. Meredith, Jones & Sons (Ltd.).....	Cambrian Leather Works, Wrexham.....	Light and roller leather manufacturers.
G. B. Moores.....	Gee Cross, Hyde.....	Chamois leather dresser.
E. & J. Richardson.....	Elswick Leather Works, Newcastle-on-Tyne.....	Fancy leather manufacturers.
G. W. Russell & Son.....	Hitchin, Herts.....	Fellmongers and leather manufacturers.
W. Ruttenau & Co.....	Good Hope Mill, Ashton-under-Lyne.....	Leather dressers.
A. & J. Shaw (Ltd.).....	Grantham.....	Splits, chamois, and fancy leather.
Wyvern Kid Co. (Ltd.).....	Banbury, Oxon.....	Chrome leather.
Wargl & Co.....	Barbourne Leather Works, Worcester.....	Chrome calf, glazed kid, and glove.

SCOTLAND.

W. & J. Martin.....	63 Brunswick St., Glasgow.....	Chrome leather tanners and curriers.
Gryffe Tanning Co.....	Bridge of Weir, near Glasgow.....	Leather dressers and curriers.
John Lees & Co.....	Lorne Tannery, Maybole.....	Pig, sheep, and calf tanners.
Harry Beebe & Co.....	Ayr.....	Pig and dressed leather.
J. Hewit & Sons.....	City Tanworks, Edinburgh.....	Goat, sheep, and calf tanners.
White, Burns & Co.....	Bonnington, Edinburgh.....	Sheepskin tanners.
Wm. Stephen, Sons & Co.....	Arolic Tannery, Dundee.....	Seal, porpoise, and whale tanners.
E. T. Holden & Son.....	Bathwell Tannery, Belth.....	Pigskin tanners and dressers.

IRELAND.

Williamson Bros. (Ltd.).....	46 Royal Ave., Belfast.....	Upper leather tanners.
Jas. Harper.....	Fountain Hill Tannery, Londonderry.....	Do.
Thomas Jones & Co.....	New Ross.....	Do.
John Ryan, sr.....	Church St., Thomastown.....	Do.
Ryan & Son.....	Thomastown.....	Do.
John Atkins.....	Dunmanway, County Cork.....	Do.
Jeremiah Morrissey.....	26 Watercourse Rd., Cork.....	Calf leather tanners.
Dennis Neenan.....	42 Great Britain St., Cork.....	Do.

GLAZED KID MANUFACTURERS.

Name.	Address.
Ward & Co. (Ltd.).....	Worcester.
Charles Case & Sons.....	Frome.
British Chrome Tanning Co. (Ltd.).....	Northampton.
Charles F. Stead & Co. (Ltd.).....	Leeds.
East, Kinsey & East.....	Bermundsey, London.
J. Salomon & Co.....	Do.
London Chrome Tannery (Ltd.).....	Do.
Tebbitt Bros.....	Do.
George Whiclow.....	Do.
Wyvern Kid Co. (Ltd.).....	Warrington.

DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 50

SHOE AND LEATHER TRADE IN GERMANY

By

ARTHUR B. BUTMAN

Commercial Agent of the Department of Commerce and Labor

TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD



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LETTER OF TRANSMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,

Washington, June 11, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1912, approved March 4, 1911, a report by Commercial Agent Arthur B. Butman, of this department, containing the result of his investigations of the shoe and leather trade in Germany.

Respectfully,

BENJ. S. CABLE,
Acting Secretary.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, April 18, 1912.

SIR: I have the honor to submit herewith a report by Commercial Agent Arthur B. Butman on the shoe and leather trade of Germany. Mr. Butman's investigations were along lines similar to those followed in the United Kingdom and embraced a study of the German boot and shoe and tanning industries as well as of the trade in tanning materials, hides and leather, and boots and shoes.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

To Hon. CHARLES NAGEL,
Secretary of Commerce and Labor.

SHOE AND LEATHER TRADE IN GERMANY.

BOOT AND SHOE INDUSTRY.

The boot and shoe manufacturing industry in Germany, while more or less widely distributed throughout the Empire, has certain centers of activity. Cheap and medium grades of McKay work are manufactured at Pirmasens and Weissenfels, heavy work at Tuttlingen, and turned work in Berlin, while the better grades of both McKay and Goodyear work are produced at Erfurt and Offenbach on the Main.

Pirmasens is probably the most widely known shoe-manufacturing center. The industry has existed in this town since 1791, having been originally devoted to the manufacture of plush and felt footwear with leather soles. In 1905 there were 202 shoe factories in Pirmasens, 14 shoe-heel factories, 3 shoe-last factories, 16 tanneries, 17 leather merchants, and 28 boot and shoe wholesale merchants.

The industry in the Empire as a whole is advancing, as regards both quantity and quality of product. Generally speaking, the factory buildings are modern, the tendency among manufacturers during recent years having been to construct the most practical factories possible. Such buildings are of brick, with high walls, affording good light and air; cement floors; modern sanitary arrangements; individual lockers for operatives; refreshment rooms with tables and benches, where individual lunches may be eaten; also counters where lunches may be purchased at nominal prices. The average structure is two to four stories in height, one-floor factory buildings after the English style of construction being rare.

FACTORY EQUIPMENT—TRADE IN SHOE MACHINERY.

As regards machinery, in some respects German factories are as fully equipped as the American. The machinery is installed according to the American system, though more floor space is allowed. In stock fitting, pulling over, and lasting particularly, there is a tendency to follow old methods. Broadly speaking, however, German manufacturers are progressive, marked conservatism in method being confined chiefly to smaller concerns.

Prior to 1889, when the American Goodyear machines were first introduced into Germany, the boot and shoe industry was of comparatively small importance. At that time other shoemaking machines of American origin were used, such as the American heeling and finishing machines and the McKay sole-sewing machine, but these were not very numerous. The first McKay sewer used in Germany was installed in the factory of Mr. S. Wolf, at Mainz.

The establishments then existing were small, and most of the operations were performed by hand. The output was smaller, while

the expense of production was, of course, much greater than under the modern system. All the better grades of domestic footwear were of the custom, or to-order handmade type.

The quantity of machinery for the shoe and leather industries imported from and exported to various countries in 1909 and 1910, and the total value of the imports and exports for these years, are shown in the following statement:

Countries.	1909	1910	Countries.	1909	1910
IMPORTS.			EXPORTS—continued.		
	<i>Pounds.</i>	<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>
United Kingdom.....	150,700	144,100	Denmark.....	90,860	223,520
United States.....	626,340	691,240	France.....	563,880	625,030
			Italy.....	491,480	532,630
Total.....	777,040	835,340	Netherlands.....	209,000	235,840
Total value.....	\$190,876	\$203,490	Russia.....	744,200	944,466
EXPORTS.			Sweden.....	208,120	286,000
Argentina.....	106,480	143,000	Switzerland.....	134,880	154,680
Austria-Hungary.....	1,273,360	1,563,540	United Kingdom.....	350,900	533,940
Belgium.....	255,800	397,100			
			Total.....	4,429,040	5,638,700
			Total value.....	\$1,228,556	\$1,552,474

SHOE-MACHINERY MANUFACTURERS.

It is difficult to state even approximately the proportion of shoe-making machinery supplied to German manufacturers by the German United Shoe Machinery Co. (affiliated with the United Shoe Machinery Co., of Boston, Mass.) and competing shoe-machinery concerns. It is safe to state, however, that by far the larger part of the equipment is furnished by the German United Shoe Machinery Co.

The well-known Maschinenfabrik "Moenus" A. G., Frankfort on the Main, originated from the firm of Webber & Miller founded in 1862. The latter, in 1889, amalgamated with the firms of S. Larabee and W. H. Gros and formed a limited company which, since 1900, has been known as the "Moenus" plant. Being a purely German concern it does a large business, especially in the Government's military workshops. It copies practically everything it can of American invention in shoemaking machinery, and also manufactures copies of American tanning machinery.

Nollesche Werke, Weissenfels, originally a nail and chain manufacturing concern, began the manufacture of shoe machinery a few years ago, the principal machines produced being copies of American equipment. The firm is also agent for foreign shoemaking machinery.

The Atlas Werke, Leipzig, originally copied the Eppler welt machines, but various difficulties in connection with the construction of the machines were experienced; and I understand the Eppler system has since been dropped, and that copies of the old Goodyear welter and stitcher are now being manufactured.

Robert Kiehle and Chn. Mansfield, Leipzig, compete principally among the smaller shoe manufacturers, their chief lines being dieing-out presses and wax-thread sewing machines for shoe-repairing outfits.

Rudolf Ley, Arnstadt, confines his output to various kinds of wood-pegging machines, which are sold chiefly to the smaller manufacturers.

Keats Maschinen Gesellschaft, Frankfort on the Main, is probably one of the oldest shoe-machinery firms, but, I am told, it is rapidly losing its hold on the business in this country.

Adrian & Busch, Oberursel, manufacture a welter and stitcher which finds some sale. They also manufacture copies of a number of American accessory machines for shoemaking.

There are several small local shoe-machinery manufacturers in different shoe centers, such as Ferd. Schäfer & Söhne and J. Sandt, in Pirmasens. Manufacturers of this class, however, produce inferior machines, their chief trade being in supplies and repairing.

The cost of the machinery manufactured by the firms mentioned is less than that of the same furnished by the German United Shoe Machinery Co., but the relative efficiency is also correspondingly less.

SHOE-MANUFACTURING CENTERS—NATURE OF OUTPUT.

In Germany shoe manufacturers who specialize are the exception; the output of individual factories usually includes footwear for both sexes and for all ages, and often all grades. More McKay-sewn goods are manufactured than any other class, followed by Goodyear-welt, pegged, and turned, in the order mentioned. No Standard-screwed boots or shoes are made in Germany.

The manufacture of canvas footwear is just being introduced, but very few canvas shoes have been made up to the present time. Very cheap grades of shoes or slippers are made in large quantities, as are also felt shoes and house slippers. The principal center for the manufacture of the latter classes of footwear is in Wurttemberg (Heilbronn), and the products are usually known on the market as "Heilbronn articles." These goods are made by attaching the sole to the inner sole and upper with tacks, generally by hand. A list of the principal boot and shoe manufacturers in Germany, with firm name and location and a statement as to the quantity and character of their output, will be found on pages 36-48.

The German manufacturer builds his footwear both on the long, narrow last of French shape and on the swing last in American style. At present, American-shaped lasts have the preference. Cuban heels are used for women's lines, and a lower heel, known in Germany as the English heel, for men's boots and shoes. Glazed kid is now largely used for women's and for men's lighter-class goods (patent-leather tips being very generally used on both) and box calf for heavier lines. Very little patent leather is made up by German manufacturers. On better grades the tendency is to make the boot or shoe as light as possible.

All manufacturing operations are usually carried on within the factory building; comparatively few home workers are employed, with the exception of the home employment on the cheapest grades of house slippers, felt shoes, etc., already noted, and then often only in districts where a sufficient number of female factory workers is not obtainable.

EMPLOYEES—WORKING HOURS—LABOR ORGANIZATIONS.

There are comparatively more female operatives in German than in American shoe factories. They are employed exclusively in stitching rooms, and also share various operations ordinarily performed by boys or youths. The school laws of the Empire prohibit the employment of children in factories, and inspection is very strict.

The working hours are practically 56 per week, not including the short morning and afternoon recesses. While the hours in shoe factories vary somewhat, the average periods are from 7 a. m. to 12 m., with a recess from 8.30 to 8.45, and from 1.15 p. m. to 6 p. m., with a recess from 4 to 4.15.

In certain more progressive factories, where better grades of footwear are made, Americans are employed as superintendents. The number is small, however, probably not more than half a dozen at the present time. In efficiency, so far as can be ascertained, German shoe operatives of both sexes would seem to average about one-third less than American.

Labor troubles are not frequent, and in practically every instance have been confined to the factory in which the trouble originated. There is an organization of shoe manufacturers, its chief purpose being to meet labor demands and to support each other in wage movements. There is no special organization of boot and shoe operatives, but they are included in a general labor organization, from which, in case of strike or lockout, employees receive a certain allowance.

WAGE SCALES.

Wages vary with localities and conditions. The lists that follow show the amount paid for various operations. In some instances wages are computed by the week, in others by the day, and in still others by the piece. Where the piecework system is employed, the operator's average output per hour or per day of 9 hours is generally stated.

CUTTING AND STITCHING ROOM.

Operations.	Rate.	Operations.	Rate.
	<i>Per week.</i>		<i>Per dozen pairs.</i>
Pattern designing.....	\$12.50-\$20.00	Blucher vamp marking.....	\$0.0075-\$0.0135
Pattern grading on Hartford machine.....	6.25- 7.50	Crimping on Lockett machine:	
Pattern cutting on pattern shears.....	5.00- 6.00	Box calf creoles.....	.065 - .085
Pattern binding.....	4.50- 5.75	Patent leather creoles.....	.15 - .20
Lining cutting on revolution press.....	4.50- 5.50	Blucher vamps, box calf.....	.015 - .0175
Lining pricking on Boston machine.....	3.00- 3.75	Blucher vamps, patent leather.....	.0375- .04
Lining marking:		Skiving:	
On power lining marker.....	1.005	Glazed kid—	
Hand.....	2.25- 3.00	Men's and women's.....	.03 - .035
Cutting outsides:		Misses' and children's....	.0225- .0325
On fine leather, by machine.	6.50- 8.75	Box calf—	
On medium and heavy grades.....	5.50- 6.50	Men's and women's.....	.0225- .03
Cutting, trimming, etc., on small machine.....	2.50- 4.00	Misses' and children's....	.0175- .025
Stamping upper leather on power machines.....	1.03- .04	For fine grades, folded—	
		Men's and women's.....	.05 - .06
		Misses' and children's....	.04 - .05
		Box calf, fine grades—	
		Men's and women's.....	.04 - .05
		Misses' and children's....	.035 - .045

¹ Per dozen.

² Per 100 pieces.

CUTTING AND STITCHING ROOM—Continued.

Operations.	Rate.	Operations.	Rate.
Folding on Lufkin machine:		Perforating on Royal machine:	
Straight vamps—	<i>Per dozen pairs.</i>	Straight vamps—	<i>Per dozen pairs.</i>
Men's.....	\$0.06 - \$0.07	Men's and women's.....	\$0.02 - \$0.025
Women's.....	.06 - .065	Misses' and children's.....	.015 - .0175
Misses' and children's.....	.04 - .065	Top quarters.....	.01 - .015
Circular vamps—		Circular vamps—	
Men's.....	.035 - .04	Men's and women's.....	.02 - .025
Women's.....	.025 - .035	Misses' and children's.....	.0175 - .02
Misses' and children's.....	.02 - .025	Heel foxings.....	.01 - .015
Straight toe caps—		Straight toe caps.....	.0075
Men's and women's.....	.0125	Winged toe caps.....	.015 - .02
Misses' and children's.....	.01	Eyelet facings—	
Pointed toe caps.....	.025	Bals.....	.02
Winged toe caps.....	.03	Bluchers.....	.02 - .025
Wave heel foxings—		For oxfords.....	.0175
Men's and women's.....	.02	For bluchers.....	.015
Misses' and children's.....	.015	Perforating on Knight machine,	
Pointed heel foxings.....	.03	toe caps.....	.0037
Button flies.....	.025	Pasting in middle linings on	
Top quarters—		Hub lining cements.....	.005 - .0125
Men's and women's.....	.02	Plumping with Simplex electric	
Misses' and children's.....	.015	heated press.....	.05
Bluchers (nose by hand).....	.04	Seam rubber, power.....	.075
Folding on Booth machine:		Beading tops:	
Top quarters—		On Columbia beader.....	.02
Men's and women's.....	.01	On Monarch beader.....	.0125
Misses' and children's.....	.0075	Hooking on Peerless hooker.....	.015
Blucher top quarters, in		Eyeletting:	
three operations (nose,		On Duplex—	
front, and vamp line).....	.0225 - .0275	Men's.....	.0075
Heel foxings—		Women's.....	.0125
Men's and women's.....	.0075	Blucher oxford.....	.0075
Misses' and children's.....	.0075	Halfway up, and punch-	
Straight toe caps.....	.0025	ing holes for hooking ..	.0125
Pointed toe caps.....	.0075	On Peerless—	
American jockey back straps	.0125	Men's.....	.0125
Straight tops.....	.01	Women's.....	.02
Sides of straight vamps		Blucher oxford.....	.04
without throw.....	.015	Halfway up, and punch-	
		ing holes for hooking ..	.02
		Lacing, on Ensign lacer.....	.0062

SOLE-LEATHER ROOM.

Operations.	Rate per 100 pairs.			Average daily output.	Average daily wages.
	Men's.	Wom- en's.	Girls' and chil- dren's.		
FOR ALL ARTICLES.					
Leather stripping.....				<i>Pairs.</i>	
Rolling sole leather.....					\$1.20
Splitting sole leather.....					to
Dieing out soles from the hide:					1.40
According to order.....	\$0.24	\$0.24	\$0.20	500-600	1.30
For stock.....	.14	.14	.12	900-1,000	1.30
Dieing out soles from strips.....	.10	.10	.08	1,400-1,500	1.30
Dieing out insoles.....	.12	.12	.10	1,000-1,200	1.20
Dieing out counters and box toes.....	.10	.10	.10	1,200-1,300	1.20
Dieing out side linings, tar-felt and shank pieces.....					1.00
Dieing out lifts.....					to
Dieing out pieced lifts.....					1.20
Rounding soles with Planet machine.....	.30	.30	.24	400-450	1.20
Single pairs.....	.36	.32	.30		
Rounding insoles with Planet machine.....	.16	.14	.12	900	1.20
Evening and marking with Nichols machine.....	.03	.03	.03	3,000	.90
Marking (numbering) soles, insoles, and counters.....	.01	.01	.01	5,000	.60
Tacking rands on lifts with power welt tacker.....	.08	.06	.06	1,000-1,200	.70
Cutting rands from strips with Universal machine.....	.04	.04	.04	2,000-3,000	.80
Cutting rands from counter offal with Scott machine.....	.06	.06	.04	1,200-1,500	.70
Counter nicking.....	.03	.03	.03	2,000	.60
Counter rolling.....	.04	.04	.04	2,000	.80
Counter molding.....	.08	.08	.08	800-1,000	.80
Splitting strips for beveled lifts on Champion machine.....	.006	.006	.006	1,200-1,500	.80
Building heels with Clinch machine.....	.12	.12	.10	600-800	.80
Building women's high heels with Pyramid or Eclipse machine, including pressing.....	.20	.24	.16	400-450	.90
Compressing heels with No. 4 press.....	.02	.02	.02	5,000-6,000	1.00
Condensing top lifts.....	.02	.02	.02	5,000-6,000	1.00

SOLE-LEATHER ROOM—Continued.

Operations.	Rate per 100 pairs.			Average daily output.	Average daily wages.
	Men's.	Wom-en's.	Girls' and chil-dren's.		
FOR GOODYEAR WORK ONLY.					
Evening and sorting insoles and counters.....	\$0.10	\$0.10	\$0.10	<i>Pairs.</i> 1,000	\$1.00
Skiving leatherboard shank pieces on Davis machine..	.06	.06	.06	900-1,200	.70
Channeling insole, Gem.....	.20	.20	.16	700- 800	1.20
Channeling all-leather insole:					
With Universal machine.....	.24	.24	.20	500- 600	1.20
With old-style Goodyear machine.....	.30	.30	.24	500	1.20
Insole lip cutting, scoring, and sizing.....	.04	.04	.04	1,500	.70
Lip turning.....	.06	.06	.06	1,000-1,200	.70
Cementing Gem insole.....	.09	.09	.07	600- 800	.55
Making Gem insole, canvas machine.....	.12	.12	.10	600	.70
Shank skiving Goodyear soles.....	.06	.06	.04	1,500-1,500	.80
Flexing all-leather insoles with Goodyear insole-flex- ing machine.....	.04	.04	.04	2,000	.70
Skiving counters with Monarch or Scott machine.....	.06	.06	.04	1,500-2,000	1.00
Buffing counters and box toes.....	.08	.08	.06	1,000	.80
FOR CHEAPER GRADES M'KAY AND PEGGED WORK.					
Channeling McKay soles with Apex machine.....	.10	.10	.08	1,000-1,200	1.00
Reenforcing McKay insoles with leatherboard, and pressing.....	.06	.06	.06	1,000-1,200	.70
Feather edging McKay inner soles.....	.06	.06	.06	1,200-1,400	.80
Tacking rands on soles with power welt tacker.....	.12	.12	.10	600	.70
Tacking forepart filler and shank piece to sole with USMC No. 1 tacker or staple tacker.....	.10	.10	.08	1,000	1.00
Skiving counters with Scott machine for McKay work, split leather, etc.....	.12	.10	.08	1,000-1,200	1.00
Sole molding:					
With model C machine.....	.04	.04	.04	3,000	1.10
With single machine.....	.08	.08	.08	800	.70
Channel opening with No. 4 channeling machine.....	.05	.04	.04	1,500	.70
FOR BETTER GRADES M'KAY WORK, WITH FAIR- STITCHED FOREPART.					
Evening and sorting insoles and counters.....	.10	.10	.10	1,000	1.00
Skiving leatherboard shank pieces with Davis machine.	.06	.06	.06	900-1,200	.70
Channeling McKay soles with Apex machine.....	.10	.10	.08	1,000-1,200	1.00
Reenforcing McKay insoles with leatherboard, and pressing.....	.06	.06	.06	1,000-1,200	.70
Feather edging McKay inner soles.....	.06	.06	.06	1,200-1,400	.80
Skiving counters with Scott machine.....	.06	.06	.06	1,200-1,500	1.00
Buffing counters and box toes.....	.08	.06	.06	1,000	.80
Sole molding:					
With model C machine.....	.04	.04	.04	3,000	1.10
With single machine.....	.08	.08	.08	800	.70
Channel opening with No. 4 machine.....	.05	.04	.04	1,500	.70

GOODYEAR-WELT WORK.

Sorting lasts.....	\$0.06	\$0.06	\$0.06		\$1.00
Tacking on insole with staple tacker.....	.08	.08	.07	1,000-1,200	.80
Tacking on insole with staple tacker, including tacking on, reinforcing piece at heel, and trimming heel seat where necessary.....	.14	.14	.12	600- 700	.80
Sorting uppers and laying them with lasts.....	.06	.06	.06		1.00
Pasting counter and box toe:					
If box toe is stitched in.....	.48	.48	.36	200- 250	1.00
If box toe is not stitched in.....	.60	.60	.48	180- 200	1.00
Assembling by machine.....	.08	.08	.07	1,200-1,500	1.10
Pulling over by machine.....	.40	.40	.30	360- 400	1.40
Pulling up lining and tacking sides of heel seats.....	.24	.24	.20	450- 500	1.20
Lasting on Consolidated (complete).....	.96	.90	.80	150- 180	1.48
Lasting heel seats and sides on Consolidated.....	.56	.50		250- 300	1.48
Lasting toes on No. 5 machine.....	.72	.72		200- 250	1.48
Trimming upper leather, Rex machine.....	.12	.12	.12	800- 900	1.00
Pounding heel seat and tapping up toe on rotary ma- chine.....	.30	.30	.24	450	1.20
Pulling lasting tacks, removing toe wire, and resetting tacks to hold upper before welting, by hand.....	.18	.16	.12	350- 400	.70
Inseaming:					
With model K machine.....	.30	.36	.24	700- 800	2.00
With old machine.....	.60	.35	.48	300- 350	2.00

GOODYEAR-WELT WORK—Continued.

Operations.	Rate per 100 pairs.			Average daily output.	Average daily wages.
	Men's.	Wom-en's.	Girls' and chil-dren's.		
Pulling insole staples and tacks holding upper.....	\$0.10	\$0.10	\$0.08	<i>Pairs.</i> 600- 700	\$0.70
Inseam trimming, Universal machine.....	.16	.16	.12	600- 700	1.10
Skiving ends of welt and fastening with small tacks....	.10	.10	.10	600- 700	.70
Beating welt.....	.12	.12	.10	600- 700	.80
Filling bottom:					
With "Besto".....	.12	.12	.10	500- 600	.60
With tar-felt.....	.20	.20	.16	350- 400	.70
Tacking in shank piece with USMC No. 1 tacker.....	.10	.10	.08	1,000-1,200	1.00
Cementing bottom with Economy cementer.....	.06	.06	.06	1,000-1,200	.65
Cementing soles with Julian cementer.....	.04	.04	.04	1,500-2,000	.70
Sole laying.....	.20	.20	.16	500- 600	1.00
Sole rounding and channeling.....	.36	.36	.32	500- 600	1.80
With double sole.....	.48	.48	.36	400- 500	1.80
Channel opening.....	.10	.10	.08	1,000	1.00
Stitching:					
With model M machine.....	.40	.40	.36	350- 400	1.50
With old-style machine.....	.60	.60	.48	200- 240	1.50
Channel cementing with Star machine.....	.06	.06	.06	1,000-1,200	.70
Channel closing.....	.08	.08	.08	800- 900	.70
Stitch wheeling with Goodyear indenting and bur-nishing machine.....	.18	.18	.14	500- 600	1.00
Leveling and edge raising.....	.30	.30	.24	500- 600	1.50
Heel-seat nailing with loose nailer or Davey machine....	.14	.14	.10	1,000	1.20
Heel-seat trimming.....	.10	.10	.10	1,000-1,200	1.00
Scouring shank and heel seat before heeling.....	.10	.10	.08	600- 700	.70
Edge trimming in pairs.....	.96	.84	.72	120- 150	1.20
Attaching heels with Lightning machine:					
On the lasts.....	.36	.36	.24	450- 500	1.50
Without lasts.....	.30	.30	.20	500- 600	1.50
High heels:					
On the lasts.....		.48	.36	250- 300	1.50
Without lasts.....		.40	.32	400	1.50
Slugging.....	.14	.14	.12	600- 800	1.00
Slugging loose heels.....	.10	.10	.10	1,200-1,500	1.00
Heel trimming.....	.12	.12	.12	1,000-1,200	1.20
High heels.....		.18-.24		600- 700	1.20
Heel breasting.....	.12	.16	.12	1,000	1.20
On loose heels.....	.06	.08	.06	2,000	1.20
Heel scouring:					
Coarse—					
Low heels.....	.42	.42	.36	300- 360	1.50
High heels.....		.50		300- 350	1.50
Fine—					
Low heels.....	.24	.24	.18	500- 600	1.30
High heels.....		.28		500- 550	1.30
Heel-breast scouring with model N machine.....	.12	.16	.10	600- 800	1.00
Jointing shank and heel, by hand.....	.30	.30	.30	450- 500	1.50
Gumming and twice blacking edge.....	.24	.20	.16	500	1.00
Edge setting:					
Three times.....	1.20	.96	.72	120- 150	1.50
Twice.....	.84	.72	.60	250- 300	1.50
Stitch burnishing, Booth machine.....	.24	.24	.18	400- 450	1.00
Top-lift sanding.....	.10	.10	.08	1,000	1.00
Bottom scouring, for part.....	.10	.08	.08	800- 900	1.00
Buffing bottom and top lift cleaning.....	.30	.30	.24	450- 500	1.20
Blacking heels and bottoms twice:					
With Crest machine.....	.12	.12	.10	600	.70
By hand.....	.12	.12	.08	600	.70
Polishing heels and beading edge with Xpedite.....	.24	.24	.24	400- 450	1.00
High heels.....		.30		400	1.00
Polishing heels and beading edge with Universal.....	.20			500- 600	1.00
Polishing bottoms and top lifts (black or brown).....	.48	.48	.36	250	1.20
Coloring and brushing fore part.....	.28	.24	.18	500	1.20
Blackening and polishing shank.....	.24	.24	.18	500	1.20
Rubbing up bottoms and cleaning slugs.....	.96	.84	.48	130- 150	1.20
Drawing lasts.....	.24	.24	.20	450- 500	1.00
Stamping trade-mark on soles with Regent.....	.08	.08	.08	1,200	1.00
Laying heel-seat sock lining and examining inside of shoe for tacks.....	.24	.24	.20	300- 400	.70
Cleaning upper leather with machine.....	.12	.12	.10	500- 600	.70
Cleaning lining.....	.10	.10	.08	600- 800	.70
Ironing upper with Miller machine.....	.40	.40	.40	150- 180	.70
Lacing or buttoning.....	.10	.10	.08	500- 600	.60
Packing.....	.10	.10	.10	500- 600	.60

McKAY-SEWN WORK WITH FAIR-STITCHED FORE PART.

Operations.	Rate per 100 pairs.			Average daily output.	Average daily wages.
	Men's.	Wom-en's.	Girls' and children's.		
Sorting lasts.....	\$0.06	\$0.06	\$0.06	Pairs.	\$1.00
Tacking on insole with staple tacker.....	.08	.08	.08	1,000-1,200	.80
Sorting uppers and laying them with lasts.....	.06	.06	.06		1.00
Pasting counter and box toe:					
If box toe is stitched in.....	.48	.48	.36	200- 250	1.00
If box toe is not stitched in.....	.60	.60	.48	180- 200	1.00
Assembling by machine.....	.08	.08	.07	1,200-1,500	1.10
Pulling over by machine.....	.24	.24	.20	500- 700	1.40
Lasting on Consolidated (complete).....	.76	.70	.54	200- 250	1.45
Pulling insole staples.....	.04	.04	.04	1,800-2,000	.70
Pounding with rotary pounding-up machine.....	.30	.30	.24	450- 500	1.20
Bottom filling, fastening shank piece and tap with staple tacker or USMC No. 1 tacker.....	.30	.30	.24	450- 500	1.20
Sewing taps with Rapid McKay sewer.....	.16	.16	.12	800- 800	1.20
Relasting.....	.24	.20	.18	350- 400	1.00
Tacking on soles and heel seats (heel seats with 3 nails).....	.24	.24	.18	450- 500	1.10
Pounding heel seats and drawing lasts.....	.32	.32	.24	650	1.10
Heel-seat nailing with loose nailer or Davey.....	.14	.14	.10	1,000	1.20
Heel-seat trimming.....	.10	.10	.10	1,000-1,200	1.00
Stitching fore parts with Goodyear Rapid machine.....	.30	.30	.20	400- 450	1.20
Sewing shanks with Rapid McKay sewer.....	.16	.16	.12	800	1.20
Channel cementing with Star.....	.08	.08	.08	1,000-1,200	.70
Channel closing.....	.08	.08	.08	800	.70
Stitch wheeling with Booth machine.....	.18	.18	.14	500- 600	1.00
Leveling with Hercules or Cyclops leveler and edge raising.....	.18	.18	.16	700- 800	1.20
Randing and edge trimming.....	.60	.60	.48	200- 250	1.20
Scouring shank and heel seat before heeling.....	.10	.10	.08	600	.70
Attaching heels with Lightning machine:					
On the lasts.....	.36	.36	.24	450- 500	1.50
Without lasts.....	.30	.30	.20	500- 600	1.50
High heels:					
On the lasts.....		.48	.36	250- 300	1.50
Without lasts.....		.40	.32	400	1.50
Attaching heels with rapid nailer.....	.20	.20	.20	800-1,000	1.50
Slugging.....	.14	.14	.12	600- 800	1.00
Slugging loose heels.....	.10	.10	.10	1,200-1,500	1.00
Heel trimming.....	.12	.12	.12	1,000-1,200	1.20
High heels.....		.18-.24		600- 700	1.20
Heel breasting.....	.16	.16	.12	1,000	1.20
On loose heels.....	.06	.08	.06	2,000	1.20
Fetching finishing lasts and relasting.....	.24	.24	.20	500	1.00
Heel scouring:					
Coarse—					
Low heels.....	.42	.42	.36	300	1.50
High heels.....		.60		300- 350	1.50
Fine—					
Low heels.....	.24	.24	.18	500- 600	1.30
High heels.....		.28		500- 550	1.30
Heel-breast scouring with model N machine.....	.12	.16	.10	600- 800	1.00
Jointing shank and heel, by hand.....	.30	.30	.30	450- 500	1.50
Edge blacking, twice.....	.16	.16	.12	600	1.00
Edge setting, twice.....	.60	.60	.48	250	1.50
Stitch burnishing with Booth machine.....	.18	.18	.14	500- 600	1.00
Bottom and top lift scouring.....	.22	.16	.16	600- 800	1.20
Bottom and top lift buffing, cleaning.....	.30	.24	.20	450- 500	1.20
Blacking heels (twice) with Crest machine.....	.12	.12	.10	600	.70
Blacking bottoms by hand, twice.....	.12	.12	.08	600	.70
Polishing heels and beading edge with Xpedite.....	.24	.24	.24	400- 450	1.00
High heels.....		.30		450	
Polishing heels and beading edge with Universal machine.....	.20	.20	.20	500- 600	1.00
Polishing bottoms and top lifts (black or brown).....	.48	.48	.36	250	1.20
Coloring and brushing fore part.....	.28	.24	.18	500	1.20
Blacking and polishing shank.....	.24	.24	.18	500	1.20
Ornamenting shanks.....	.30	.24	.18	350- 400	1.00
Rubbing up bottoms, cleaning slugs, and drawing lasts.....	.60	.52	.44	150- 180	1.00
Laying heel-seat sock lining.....	.20	.20	.18	600	1.00
Stamping trade-mark on soles with Regent.....	.08	.08	.08	1,200	1.00
Cleaning upper leather with machine.....	.12	.12	.10	500- 600	.70
Cleaning lining.....	.10	.10	.08	600- 800	.70
Ironing upper with Miller machine.....	.40	.40	.40	150	.70
Lacing or buttoning.....	.10	.10	.08	500- 600	.60
Packing.....	.10	.10	.10	500- 600	.60

CHEAPER GRADES OF MCKAY-SEWN AND PEGGED WORK.

Operations.	Rate per 100 pairs.			Average daily output.	Average daily wages.
	Men's.	Women's.	Girls' and children's.		
				<i>Pairs.</i>	
Sorting lasts.....	\$0.06	\$0.06	\$0.06	1,000-1,200	\$1.00
Tacking on insole with staple tacker.....	.08	.08	.08		.80
Sorting uppers and laying them with lasts.....	.06	.06	.06		1.00
Pasting counter and box toe:					
If box toe is stitched in.....	.48	.48	.36	200- 250	1.00
If box toe is not stitched in.....	.60	.60	.48	180- 200	1.00
Assembling by machine.....	.08	.08	.08	1,200-1,500	1.10
Pulling over by machine.....	.24	.24	.20	500-1,000	1.40
Lasting on Consolidated (complete).....	.72	.64	.48	250- 300	1.50
Pulling insole staples.....	.04	.04	.04	1,500-2,000	.70
Pounding with rotary pounding-up machine.....	.30	.30	.24	450- 500	1.20
Tacking on soles and nailing heel seats with taper nail tacker.....	.30	.30	.24	400- 450	1.10
Heel-seat trimming.....	.08	.08	.06	1,200-1,500	1.00
Pounding heel seats and drawing lasts.....	.30	.24	.20	400- 450	1.10
Sewing with Rapid McKay sewer.....	.24	.24	.18	600- 800	1.30
Sewing with old-style McKay machine.....	.36	.36	.24	400- 500	1.30
Pegging with Davey machine.....	.36	.30	.24	400- 500	1.30
Channel cementing with Star.....	.06	.06	.06	1,000-1,200	.70
Channel closing.....	.08	.08	.08	800	.70
Leveling with Hercules or Cyclops leveler and edge raising.....	.18	.18	.16	700- 800	1.20
Randing and edge trimming.....	.48	.48	.36	250- 300	1.20
Randing and edge trimming (for edges without stitch wheeling).....	.36	.36	.30	350- 400	1.20
Attaching heels with Lightning machine:					
On the lasts.....	.36	.32	.18	450- 500	1.40
Without lasts.....	.30	.28	.16	500- 600	1.40
High heels:					
On the lasts.....		.48	.30	200- 350	1.40
Without lasts.....		.36	.24	400- 450	1.40
Attaching heels with rapid nailer.....	.20	.20	.20	800-1,000	1.50
Slugging.....	.14	.12	.12	600- 800	1.00
Slugging loose heels.....	.10	.10	.10	1,200-1,500	1.00
Heel trimming.....	.12	.12	.12	1,000-1,200	1.20
High heels.....		.18-.24		600- 700	1.20
Heel breasting.....	.12	.12	.12	1,000-1,200	1.20
Heel breasting on loose heels.....	.06	.08	.06	2,000	1.20
Fetching finishing lasts and relasting.....	.24	.24	.20	500	1.00
Heel scouring, coarse and fine:					
Low heels.....	.44	.36	.24	300- 350	1.20
High heels.....		.60	.32	200- 250	1.20
Heel breast scouring with model N machine.....	.12	.12	.08	800-1,000	1.00
Jointing shank and heel, by hand.....	.24	.24	.20	450- 500	1.10
Edge blacking.....	.12	.12	.08	600	.70
Edge setting:					
Without stitch wheeling.....	.48	.48	.30	300- 350	1.40
With stitch wheeling.....	.60	.60	.42	200- 250	1.40
Bottom and top lift scouring.....	.20	.20	.18	600- 800	1.20
Bottom and top lift buffing, cleaning.....	.30	.24	.20	450- 500	1.20
Blackening heels and bottom, by hand.....	.12	.10	.08	600- 700	.70
Polishing heels and beading edge with Universal.....	.20	.20	.16	500- 600	1.00
Polishing bottoms and top lifts (black or brown).....	.48	.48	.36	250	1.20
Coloring and brushing fore part.....	.28	.24	.18	500	1.20
Blackening and polishing shank.....	.24	.24	.18	500	1.20
Coloring and brushing fore part and shank.....	.48	.48	.40	250- 300	1.20
Coloring and brushing pegged bottoms with oakalene.....	.28	.24	.20	450- 500	1.20
Top ironing.....	.18	.18	.12	600- 700	1.00
Ornamenting shanks.....	.30	.24	.18	350- 400	1.00
Laying sock lining.....	.12	.12	.12	800- 900	1.00
Rubbing up bottoms, cleaning slugs, and drawing lasts.....	.60	.52	.44	150- 180	1.00
Cleaning upper leather with machine.....	.12	.12	.10	500- 600	.70
Stamping trade-marks on soles with Regent.....	.06	.06	.08	1,200	1.00
Cleaning upper and lining, treeling, dressing, lacing or buttoning, and packing:					
Box calf.....	.40	.40	.36	300- 350	1.20
Glazed kid.....	.48	.48	.40	250- 300	1.20

METHOD OF FURNISHING TOOLS AND MATERIALS.

Special regulations obtain throughout the Empire as to supplying tools and materials to workpeople at an average cost price. In the shoe as in other industries certain supplies are furnished to the operatives by the manufacturers, the latter determining the quantity required by each worker and charging accordingly, the amount being reimbursed in the individual's wage. German manufacturers agree that this practice is necessary. If the supplies were furnished free, abuses and extravagance would result, while if the workers were allowed to furnish them, choosing their own sources of supply, the material would doubtless often be of inferior quality, with resultant detriment to the manufacturer's product. The supplies include needles, silk, thread, buttons, button fasteners, eyes and clasps, tacks, pegwood, iron wire, sandpaper, wax, oakaline, inks, cements, creams, etc.

COST OF LABOR AND MATERIAL FOR CERTAIN OPERATIONS.

In the following tables showing the cost of the various operations mentioned on men's high-grade glazed-kid high cuts and women's kid blucher oxfords, the reimbursements for materials used are stated.

MEN'S HIGH-GRADE GLAZED-KID BALS; GOODYEAR WELT; FOLDED VAMP; UPPER FITTED ON BLOCK WITH MIDDLE LINING; RETAIL SELLING PRICE, \$4.

Operations.	Per 100 pairs.		Average output per hour.	Average weekly wages.
	Wages.	Material.		
LINING.				
Lining and trimming tongue.....	\$0.10		<i>Pairs.</i> 72	\$3.30-\$4.05
Binding tongue with fancy stitch on 1-needle machine (silk No. 80, thread No. 24).....	.11	\$0.12	60	3.30-3.55
Closing linings (thread Nos. 24 and 50).....	.035	.015	60-72	3.30-3.80
Stitching heel stay (thread Nos. 24 and 50).....	.09	.03		
Pasting top and eyelet facings.....	.26	.005	30	3.55-4.25
Stitching top and eyelet facings (thread Nos. 24 and 50).....	.17	.045	18	3.30-3.80
Stitching pull strap (thread Nos. 24 and 50).....	.10	.005		
Sewing tongue to lining (thread Nos. 24 and 50).....	.18	.02		
TOE CAP.				
Cementing toe cap.....	.016		360-420	3.10-3.30
Folding toe cap, with Booth machine.....	.03		216	3.30-3.55
Perforating toe cap.....	.06		144	4.25-4.75
Pasting in toe cap.....	.20	.005	42	4.05-4.55
Stitching toe cap (silk No. 60, thread No. 20).....	.40	.14	24	4.25-4.75
NOTE.—Four times, 1½ cents each row.				
WHOLE VAMPS.				
Cementing vamps.....	.03		192-216	3.10-3.30
Folding vamp, with Lufkin folder.....	.28	.06	30-36	3.80-4.75
Pasting in doubler.....	.13	.03	48	3.10-3.55
Closing vamp to jockey back strap (thread No. 12).....	.26	.14	42	4.25-5.45
Seam running.....	.14		60	4.05-4.55
TOP QUARTERS.				
Sorting for operations.....	.04		156	3.10-3.30
Cementing quarters.....	.03		108-192	3.10-3.30
Folding quarters, with Booth machine.....	.06	.04	144-180	3.80-4.75
Pasting in middle lining.....	.20	.04	30	3.30-3.80
Match marking.....	.04		72	4.25-4.75
Closing top quarters (thread No. 12).....	.12	.08		
Seam rubbing, by hand.....	.04		144-180	3.10-3.30
Stitching top and lining together (silk No. 60, thread No. 20).....	.24	.09	30	4.05-4.25
Cementing.....	.02	.05	300	3.10-3.30
Beading.....	.10		72	3.30-4.05

MEN'S HIGH-GRADE GLAZED-KID BALS; GOODYEAR WELT; FOLDED VAMP; UPPER FITTED ON BLOCK WITH MIDDLE LINING; RETAIL SELLING PRICE, \$4—Contd.

Operations.	Per 100 pairs.		Average output per hour.	Average weekly wages.
	Wages.	Material.		
TOP QUARTERS—continued.				
Fitting linings.....	\$0.56	\$0.02	<i>Pairs.</i> 12- 15	\$3.55-\$4.25
Trimming lining and heel stay.....	.04		12	4.25- 5.25
Seaming tops (silk No. 60, thread No. 20).....	.52	.16		
Stitching in pull straps (silk No. 60, thread No. 20).....	.36	.05	144-156	3.55- 3.80
Trimming.....	.20			
Eyeletting.....	.05		60- 72	3.55- 4.25
Hooking.....	.04			
Putting in Pratt's fasteners.....	.08		216-240	2.85- 3.10
Lacing, with Ensign.....	.025			
Barring.....	.10	.005	60	3.10- 3.30
Seaming up toe lining (thread Nos. 12 and 20).....	.075	.01	96	3.55- 3.80
Stitching tongue to vamp lining (thread Nos. 12 and 20).....	.075	.01	108	3.80- 4.25
Fitting upper block.....	1.50	.06	6	4.25- 5.25
Vamping (silk No. 60, thread No. 20).....	.94	.34	12	4.25- 5.95
Barring.....	.05	.016	120	2.85- 3.10
Trimming linings.....	.04		.24	3.55- 3.80
Cleaning upper.....	.16			
Stapling in side stays.....	.05			
Tagging to keep pairs together.....	.06			

WOMEN'S KID BLUCHER OXFORD; McKAY-SEWN; PATENT-LEATHER PERFORATED TIP; RAW EDGE; RETAIL SELLING PRICE, \$1.80.

LINING.				
Clothing linings (thread Nos. 24 and 50).....	\$0.03	\$0.01	132	\$1.90-\$2.15
TOE CAP.				
Cementing toe cap.....	.016	.02	120-132	3.10- 3.30
Folding toe cap.....	.03			
Perforating toe cap.....	.06		78- 90	4.25- 4.75
Blacking perforations.....	.04	.002		
Pasting in toe cap.....	.12	.006	60- 66	3.80- 4.25
Stitching toe cap (silk No. 60, thread No. 20).....	.20	.07	39- 48	4.25- 5.00
CIRCULAR VAMPS.				
Pasting tongue, middle lining, drill lining, and doublers on circular vamps.....	.34	.04	18- 24	3.55- 4.05
Stitching tongue to vamp lining and stitching tongue all round.....	.34	.10	18- 24	3.55- 4.25
TOP QUARTER ON LEG.				
Raw edge blacking.....	.04	.01	144-156	2.85- 3.10
Punching top quarter at vamp.....	.20		36	3.80- 4.05
Pasting eyelet facings and trimming.....	.06		108-120	3.55- 3.80
Stitching eyelet row and tying off ends (silk No. 60, thread No. 20).....	.28	.06	24- 27	4.25- 4.75
Seaming top quarter (thread No. 12).....	.11	.09	72- 84	4.05- 5.00
Seam rubbing.....	.04		144-168	3.10- 3.55
Staying top quarter (silk No. 60, thread No. 20).....	.08	.046	84-108	3.55- 4.55
Stitching top and lining together (thread Nos. 12 and 20).....	.22	.07	30- 39	3.55- 3.80
Beading tops.....	.70	.04	9- 12	3.10- 3.80
Seaming tops (silk No. 60, thread No. 20).....	.30	.106	24- 30	4.25- 5.00
Eyeletting (5 eyelets).....	.05		132-144	3.55- 4.05
Pasting heel foxing on vamps with side linings.....	1.02	.02	6- 8	3.55- 4.25
Vamping and barring (thread No. 20).....	.62	.146	12- 16	4.05- 4.75
Third row vamping (silk No. 60, thread No. 20).....	.32	.066	24- 27	4.05- 4.75
Trimming lining and side lining.....	.04		36- 45	3.10- 3.80
Cleaning.....	.14	.002	194-240	2.85- 3.10
Lacing.....	.26			

LABOR COST FOR GOODYEAR WORK.

The following table shows approximately the labor cost, per 100 pairs, of manufacturing weekly 2,500 pairs of men's and women's Goodyear-welt shoes corresponding to a like grade manufactured in the United States at a value (factory price) of \$2.50 per pair for men's and \$2.25 for women's.

Operations.	Cost per 100 pairs.		Operations.	Cost per 100 pairs.	
	Men's.	Women's.		Men's.	Women's.
Cutting outsides and lining, including foreman's wages at \$7.14 per week.....	\$3.19	\$3.19	Heeling, including slugging and breasting.....	\$0.736	\$0.692
Closing, including skiving and foreman's wages at \$7.14 per week.....	7.50	6.90	Relasting.....	.13	.13
Sole-leather room, including heel building.....	1.08	.98	Heel trimming.....	.14	.22
Pulling over, including assembling from tacking in-sole on.....	1.14	1.022	Heel scouring, including breast.....	.614	.51
Lasting, including pounding up and upper trimming.....	1.32	1.15	Edge trimming.....	.92	.80
Wetling.....	.40	.36	Stitch wheeling and burnishing.....	.26	.30
Tack pulling, in-seam trimming, and welt beating.....	.53	.47	Edge setting and blacking.....	.974	.854
Bottom filling, including tacking in shanks, cementing bottom, and shoe.....	.34	.29	Bottom, shank, and top-piece buffing and scouring.....	.302	.282
Sole laying.....	.10	.10	Bottom finishing, including painting bottom, blacking shank and top-piece.....	.486	.486
Rounding and channeling.....	.34	.34	Heel inking.....	.06	.06
Opening channels.....	.09	.09	Heel burnishing.....	.20	.20
Stitching.....	.72	.70	Upper cleaning, drawing lasts, laying heel-seat sock lining, including stamping bottoms.....	.812	.732
Heel trimming and nailing.....	.176	.14	Treering, dressing, and crowning.....	1.126	1.126
Leveling, including channel cementing and closing.....	.594	.594	Cartoning and packing.....	.254	.254
Taking out lacers and drawing lasts.....		.154	Total.....	24.404	23.036

LABOR COST FOR M'KAY-SEWN WORK.

The approximate labor cost, per 100 pairs, of manufacturing weekly 2,500 pairs of men's and women's McKay-sewn shoes corresponding to a like grade manufactured in the United States at a value (factory price) of \$2 per pair for men's and \$1.85 for women's is shown in the table following.

Operations.	Cost per 100 pairs.		Operations.	Cost per 100 pairs.	
	Men's.	Women's.		Men's.	Women's.
Cutting outsides and linings, including foreman's wages at \$7.14 per week.....	\$3.19	\$3.19	Heel scouring, including breast.....	\$0.54	\$0.51
Closing, including skiving and foreman's wages at \$7.14 per week.....	6.90	6.90	Edge trimming.....	.70	.70
Sole-leather room, including heel building.....	.90	.90	Stitch wheeling and burnishing.....	.26	.22
Pulling over, including assembling from tacking insole on.....	.916	.912	Edge setting and blacking.....	.80	.74
Lasting, including pounding up and bottom filing.....	1.08	1.05	Bottom, shank, and top piece buffing and scouring.....	.39	.262
Sole laying, including heel-seat nailing and trimming, and drawing lasts.....	.78	.702	Bottom finishing, including painting bottom, blacking shanks and top pieces.....	.40	.386
McKay sewing.....	.30	.20	Heel inking.....	.06	.06
Leveling, including channel cementing and closing.....	.49	.422	Heel burnishing.....	.16	.16
Heeling, including slugging and breasting.....	.622	.602	Upper cleaning, including drawing lasts, laying heel-seat sock lining, and stamping trade-mark.....	.692	.692
Relasting.....	.13	.13	Treeling, dressing, and crowning.....	1.026	1.026
Heel trimming.....	.11	.22	Cartoning and packing.....	.244	.244
			Total.....	20.69	20.228

COST OF LIVING.

Rent and living expenses of the average shoe workman in Germany are about as follows:

Items.	Marks.	American currency.
House rent:		
In country, including traveling expenses to and from factory.. per month..	12- 30	\$2.86-\$7.14
In city..... do.....	30- 40	7.14- 9.52
Table expenses, heat, and light..... do.....	60- 95	14.30-22.61
Cost of insurance (municipal sick and invalid)..... per year..	30- 40	7.14- 9.52
State and municipal tax..... do.....	30- 50	7.14-11.90

The insured workman in case of illness is granted a sick allowance, free medical treatment, and medicines for a period of 13 weeks if necessary. In some cases a childbed allowance and a burial allowance are also granted.

TAXES—COST OF LAND AND BUILDINGS—POWER.

Government taxation of boot and shoe manufacturers in Germany is approximately as follows: Average municipal and State commercial tax, 10 to 12 per cent of net earnings; average workmen's accident insurance, \$1.20 per man per year; average workmen's sick and invalid insurance (municipal), \$4.75 to \$5.95 per man per year.

As previously mentioned, the present custom is to build factories from two to four stories in height, including basement, the latter being used entirely for storing, cutting, and preparing sole leather; but there is still a tendency in localities where ground prices are not prohibitive and where the capacity of the factory is to be about 500 pairs daily, to erect one-story buildings with serrated roof. The cost of a multiple-story building, exclusive of heating apparatus and

elevators, varies from \$0.83 to \$1.06 per square foot, measured inside of walls. The cost of building sites varies according to locality and averages from about \$0.60 per square yard in small villages to about \$6.75 per square yard in larger towns. The average cost in factory districts is about \$1.65 per square yard.

A manufacturer renting a factory pays an average of 6 per cent on the owner's investment in land and buildings. Leases usually contain a clause specifying the amount up to which the lessee is responsible. As in other countries, taxes vary with the locality, averaging in small villages 10 per cent of the net earnings, as against 12 per cent in larger towns. From such figures as I have been able to obtain the factory floor space required averages about 5 square feet per pair on cheap grades and 11 square feet on better grades. These estimates represent only the area required in the manufacture or handling of the shoe and do not include areas for shipping and stocking of the finished product or for offices.

Most of the modern factories are equipped with electric motors, each driving an individual shaft. Electric power is generated in the larger factories by steam engines, by which means both power and light are provided, while steam is also produced for heating purposes. The actual cost of electrical power in one factory was stated to be 1.5 cents per horsepower hour. This includes interest on investment and all expenses incident to the production of power. The guaranty given by makers of gas engines for producing power by generator gas is about 1.5 cents per horsepower hour. With a Diesel motor burning tar oil guaranties of cost are given between 1.07 and 1.18 cents per horsepower hour.

The cost of electric power naturally varies with the locality. In Frankfort on the Main small concerns using motors of one-half to 2 horsepower pay at the rate of 11.9 cents per kilowatt hour, or 8.87 cents per horsepower hour. Larger concerns using motors of about 50 horsepower pay 2.6 cents per kilowatt hour, or 1.93 cents per horsepower hour. I am told that still larger concerns would pay even less.

MANUFACTURERS' RETAIL STORES.

Several of the larger and more progressive manufacturers maintain retail stores, among whom may be mentioned the following: Conrad Tack & Co., Burg, near Magdeburg, maintaining throughout the Empire as many as 130 stores; A. Krojanker, Burg, near Magdeburg; Hancisen & Co., Cannstatt, near Stuttgart, makers of the Mercedes shoe; J. Sigle & Co., Kornwestheim-Stuttgart, manufacturers of the Salamander shoe; Max Tack, Strausberg, near Berlin; R. Dorndorf, Breslau.

The wholesale boot and shoe trade constitutes a business of considerable importance in German trade centers, notwithstanding direct selling to retailers by a large proportion of manufacturers. The terms of credit allowed to retail dealers are of considerable latitude, often from three to nine months; the average is six months against sight draft.

TANNING INDUSTRY.

The leather industry is of great economic importance in the German Empire. It is well organized in all branches, and this tends to its regulation and advancement. Organizations of buyers and sellers of raw hides and skins regulate purchases and sales at auctions. Buyers of East India kips have formed an association to bring about, if possible, better assortment. There are also an association of tanners, an association for the purchase of tanning extracts, and a shoe manufacturers' association.

The hide trade is carried on principally at Hamburg. All classes of hides and skins are imported and reexported, and all classes are included in those purchased for home consumption. The following table gives the quantity and value of the imports and exports of hides and skins during 1909 and 1910:

Articles.	Quantity.		Value.	
	1909	1910	1909	1910
IMPORTS.				
Cattle hides:	<i>Pounds.</i>	<i>Pounds.</i>		
Green and salted.....	165,881,760	205,211,820	\$22,246,336	\$27,539,456
Dry.....	77,428,340	85,388,740	17,404,504	18,816,756
Horsehides:				
Green and salted—				
Whole hides.....	14,564,220	17,060,340	1,264,468	1,406,818
Shoulders.....	290,620	681,560	99,246	106,386
Heads.....	2,090,220	4,123,900	205,634	341,768
Dry—				
Whole hides.....	3,688,740	3,540,680	736,372	672,350
Shoulders.....	331,980	1,139,600	70,686	235,144
Heads.....	776,160	572,120	107,100	134,232
Buffalo hides.....	2,757,920	3,323,320	584,528	479,808
Calfskins:				
Green and salted.....	57,862,200	56,550,780	12,472,390	12,749,184
Lined and dry.....	7,214,018	6,024,256	19,686,408	18,773,440
Lambskins, undressed:				
Wool left on.....	14,848,900	11,571,780	4,239,404	3,275,594
Wool taken off.....	31,240	86,680	22,372	20,468
Sheepskins, undressed:				
Wool left on.....	20,237,800	18,687,020	2,850,526	2,650,130
Wool taken off.....	789,360	1,383,800	226,576	374,612
Goat and kid skins, undressed.....	19,413,460	18,373,300	7,014,812	6,902,962
Other hides and skins.....	1,153,680	1,315,380	462,910	504,560
Total.....	389,360,618	435,035,076	89,774,392	94,983,658
EXPORTS.				
Cattle hides, green and salted.....	103,517,920	107,152,540	13,457,710	15,770,832
Horsehides, green and salted (whole hides).....	14,945,040	18,618,160	1,522,724	1,904,238
Calfskins, green and salted.....	23,589,060	17,851,900	5,971,896	4,497,248
Sheepskins, undressed, wool left on.....	5,998,680	6,020,960	850,850	916,062
Goat and kid skins, undressed.....	3,063,720	2,364,780	1,461,082	1,355,648
Other hides and skins.....	83,062	69,734	83,062	69,734
Total.....	151,197,482	152,078,074	23,347,324	24,513,762

IMPORTS AND EXPORTS OF HIDES AND SKINS.

The source of the imports of hides and skins and the destination of the exports are shown by the following table:

Articles and countries.	1909	1910	Articles and countries.	1909	1910
IMPORTS.			IMPORTS—continued.		
Cattle hides, green and salted:	<i>Pounds.</i>	<i>Pounds.</i>	Horsehides, dry, whole hides:	<i>Pounds.</i>	<i>Pounds.</i>
Argentina.....	53,080,060	61,615,180	Argentina.....	2,669,180	2,550,240
Australia.....	1,239,260	682,880	Russia.....	823,460	817,740
Austria-Hungary.....	25,534,300	21,449,120	Uruguay.....	166,100	172,700
Belgium.....	2,358,620	5,440,600	Total.....	3,658,740	3,540,680
Brazil.....	22,356,620	26,744,740			
Cuba.....	1,880,120	2,579,280	Horsehides, dry, shoulders:		
Denmark.....	4,852,760	4,328,720	Argentina.....	308,000	1,109,460
France.....	11,108,900	22,344,960	Russia.....	23,980	30,140
Italy.....	2,321,220	3,111,460	Total.....	331,980	1,139,600
Netherlands.....	7,082,020	9,604,980			
Paraguay.....	4,223,340	6,721,220	Horsehides, dry, heads:		
Russia.....	1,667,380	2,784,320	Argentina.....	352,000	302,280
Sweden.....	1,623,820	2,297,460	United States.....	424,160	306,840
Switzerland.....	9,944,660	10,201,180	Total.....	776,160	572,120
United States.....	2,337,720	5,213,340			
Uruguay.....	10,197,000	14,787,520	Buffalo hides:		
All other countries.....	4,073,960	5,304,860	Argentina.....	61,600	225,060
Total.....	165,881,760	205,211,820	British Indies.....	1,543,960	810,460
			China.....	333,300	1,124,640
Catt'e hides, dry:			Dutch Indies.....	819,060	1,163,140
Africa.....	1,340,020	1,746,800	Total.....	2,757,920	3,323,320
Argentina.....	9,908,800	10,177,200			
Austria-Hungary.....	783,860	764,720	Calfskins, green and salted:		
Brazil.....	10,472,440	11,499,180	Austria-Hungary.....	21,297,540	19,320,400
British Indies.....	24,757,040	27,813,940	Denmark.....	3,814,400	5,807,780
China.....	5,454,240	7,616,020	France.....	14,617,080	8,210,180
Colombia.....	1,265,660	2,977,500	Italy.....	3,856,000	2,880,020
Dominican Republic.....	640,200	618,200	Netherlands.....	786,540	1,280,300
Dutch Indies.....	2,176,240	2,545,180	Russia.....	4,608,120	2,629,440
France.....	848,980	969,760	Sweden.....	2,124,540	6,322,140
Guatemala.....	1,321,100	1,382,700	Switzerland.....	3,484,580	2,974,620
Madagascar.....	3,751,440	5,148,880	United Kingdom.....	683,320	1,358,280
Paraguay.....	662,200	452,760	United States.....	429,860	1,146,000
Peru.....	1,096,240	1,243,000	All other countries.....	2,158,420	4,606,560
United Kingdom.....	842,820	922,240	Total.....	57,802,200	56,550,780
United States.....	739,200	918,280			
Uruguay.....	5,480,200	2,613,600	Calfskins, limed and dry:		
Venezuela.....	1,389,960	1,817,420	Argentina.....	1,046,100	641,740
All other countries.....	4,495,700	4,154,160	Austria-Hungary.....	2,280,740	1,553,860
Total.....	77,428,340	85,388,740	Brazil.....	296,120	236,060
			Denmark.....	628,760	486,860
Horsehides, green and salted, whole hides:			Finland.....	294,140	1,062,180
Austria-Hungary.....	2,692,800	2,168,540	Netherlands.....	348,480	298,640
Belgium.....	769,560	1,418,340	Norway.....	249,700	248,380
Denmark.....	821,260	945,560	Russia.....	10,197,660	7,912,960
France.....	2,532,040	3,189,120	Switzerland.....	176,000	275,000
Netherlands.....	669,900	1,012,880	United States.....	49,280	191,620
United Kingdom.....	4,397,800	5,839,460	All other countries.....	586,300	628,980
United States.....	442,420	395,500	Total.....	16,153,280	13,566,300
All other countries.....	2,237,840	2,090,880			
Total.....	14,564,220	17,060,340	Lambskins, undressed, wool left on:		
			Argentina.....	1,379,620	1,144,220
Horsehides, green and salted, shoulders:			Austria-Hungary.....	3,349,720	3,710,960
France.....	153,560	492,360	France.....	1,406,020	574,420
Russia.....	137,060	189,200	Greece.....	814,220	830,000
Total.....	290,620	681,560	Italy.....	883,080	862,600
			Portugal.....	402,160	378,624
Horsehides, green and salted, heads:			Russia.....	1,246,960	882,640
United Kingdom.....	293,700	269,940	Spain.....	2,372,820	1,612,288
United States.....	1,796,520	3,853,960	Turkey.....	1,006,060	533,900
Total.....	2,090,220	4,123,900	United Kingdom.....	489,060	270,340

Articles and countries.	1909	1910	Articles and countries.	1909	1910
IMPORTS—continued.			EXPORTS.		
Lambskins, undressed wool left on—Contd.			Cattle hides, green and salted:		
Uruguay.....	<i>Pounds.</i> 486, 640	<i>Pounds.</i> 373, 560	Austria-Hungary.....	<i>Pounds.</i> 13, 161, 960	<i>Pounds.</i> 20, 197, 320
All other countries....	1, 012, 440	463, 980	Belgium.....	10, 717, 300	7, 846, 740
Total.....	14, 848, 900	11, 571, 780	Finland.....	3, 382, 500	4, 857, 380
Lambskins, undressed, wool taken off:			France.....	9, 585, 180	8, 349, 000
Denmark.....		4, 620	Netherlands.....	10, 426, 020	8, 242, 300
France.....	31, 240	82, 060	Russia.....	24, 039, 840	30, 787, 460
Total.....	31, 240	86, 680	Sweden.....	6, 396, 500	5, 435, 540
Sheepskins, undressed, wool left on:			United Kingdom.....	9, 476, 940	6, 453, 700
Algeria.....	425, 040	508, 850	United States.....	10, 292, 040	8, 333, 380
Argentina.....	2, 509, 760	1, 446, 280	All other countries....	6, 040, 540	6, 649, 720
Austria-Hungary.....	2, 889, 700	3, 099, 800	Total.....	103, 517, 920	107, 152, 540
Denmark.....	693, 220	1, 559, 140	Horsehides, green and salted, whole hides:		
France.....	2, 198, 460	1, 565, 740	Austria-Hungary.....	48, 400	320, 100
Morocco.....	953, 920	954, 580	Belgium.....	573, 540	303, 380
Russia.....	2, 032, 520	3, 385, 800	Netherlands.....	301, 620	728, 200
Spain.....	1, 728, 320	1, 309, 680	Russia.....	12, 331, 660	10, 021, 500
Turkey.....	1, 091, 640	815, 760	United States.....	1, 689, 820	1, 244, 980
United Kingdom.....	2, 458, 940	1, 608, 480	Total.....	14, 945, 040	18, 618, 160
All other countries....	2, 636, 280	2, 372, 920	Calfskins, green and salted:		
Total.....	20, 237, 800	18, 687, 020	Austria-Hungary.....	1, 354, 540	1, 604, 020
Sheepskins, undressed, wool taken off:			Belgium.....	1, 806, 640	1, 411, 960
Australia.....	229, 020	359, 920	Canada.....	295, 900	232, 100
France.....	399, 300	546, 040	Finland.....	1, 384, 900	2, 078, 120
United Kingdom.....	161, 040	477, 840	France.....	2, 302, 920	2, 141, 920
Total.....	789, 360	1, 383, 800	Netherlands.....	1, 366, 860	1, 086, 700
Goat and kid skins, un- dressed:			Switzerland.....	468, 380	482, 020
Algeria.....	606, 760	245, 960	United Kingdom.....	971, 520	608, 080
Austria-Hungary.....	1, 048, 320	2, 185, 700	United States.....	13, 328, 700	7, 038, 180
Belgium.....	261, 140	257, 180	All other countries....	309, 320	558, 800
Brazil.....	520, 520	314, 380	Total.....	23, 589, 060	17, 851, 900
British Indies.....	2, 267, 980	3, 573, 240	Sheepskins, undressed, wool left on:		
China.....	869, 060	1, 273, 140	Austria-Hungary.....	1, 282, 600	1, 143, 340
Dutch Indies.....	413, 600	405, 240	Belgium.....	1, 554, 080	1, 511, 180
France.....	4, 301, 000	3, 014, 000	France.....	409, 880	531, 740
Morocco.....	667, 480	819, 720	Netherlands.....	1, 603, 300	1, 629, 980
Russia.....	3, 019, 500	3, 092, 760	Russia.....	438, 400	638, 440
Spain.....	550, 880	420, 420	United Kingdom.....	428, 140	258, 500
Switzerland.....	423, 720	228, 580	United States.....	284, 240	307, 780
Turkey.....	722, 920	428, 780	Total.....	5, 998, 680	6, 020, 960
United Kingdom.....	874, 500	712, 360	Goat and kid skins, un- dressed:		
United States.....	719, 400	347, 820	Belgium.....	587, 180	413, 600
All other countries....	1, 246, 080	1, 054, 020	France.....	1, 547, 920	1, 106, 580
Total.....	19, 413, 460	18, 373, 300	Italy.....	59, 840	34, 540
Other hides and skins:			Switzerland.....	45, 540	59, 620
Austria-Hungary.....	921, 360	979, 880	United Kingdom.....	381, 700	506, 880
Dutch Indies.....	8, 140	7, 920	United States.....	441, 540	153, 560
United Kingdom.....	97, 460	154, 880	Total.....	3, 063, 720	2, 364, 780
United States.....	120, 720	172, 700	Other hides and skins:		
Total.....	1, 153, 680	1, 315, 380	Austria-Hungary.....	153, 780	197, 780
			United States.....	109, 560	59, 620
			Total.....	263, 340	257, 400

Buffalo hides are imported principally from the British and Dutch East Indies. Of British Indian hides, the Northwestern are preferred; and of the Dutch those coming from Batavia, Samarang, and Soerabaya. Kips come principally from Calcutta and Karachi, and some via Madras and Bombay. Partially prepared East Indian sheepskins and goatskins—that is, skins given preparatory tannage with acacia bark and myrobolans, are also shipped from Madras and Bombay. Imports from the United States consist largely of packer hides. In both the import and export trade, hides and skins are always bought and sold on cash terms, prices being quoted per half kilo (1.1 pounds). Commission houses sell to tanners on three and six months' time.

NUMBER AND CAPACITY OF TANNERIES.

The tanning industry is widely distributed, there being between 6,000 and 7,000 tanneries in the Empire. Most of these establishments, however, can hardly be considered tanneries of the present-day standard. The small establishments, in which operations are carried on by various members of a family, very often without any outside help, are devoted exclusively to the manufacture of vegetable-tanned leathers. Some are producing sole leather by the old German process, others stuffed calfskins and East India kips. Tanners of this class work for the retail trade among the country shoemakers or for contractors to the army; they usually form large associations to dispose of their goods. The leather produced is generally very solid and specially adapted for rough wear.

The smaller tanning establishments in Germany, however, are gradually disappearing, and the tendency is toward large firms using mechanical power and supplied with modern equipment by which the cost of production is reduced. Aside from the small tanners there are 1,000 to 1,200 tanneries equipped with mechanical power, and the weekly output of many of these is limited. In Germany, a medium-sized tannery is one that works about 50 hides daily; and there are about 300 tanneries that attain this output. A much smaller number of plants have a considerably larger production.

The more important tanneries are well equipped with modern tanning machinery, German manufacturers as a rule being progressive and ready to adopt new machines and improved methods. Leaving out of consideration chrome leather, which is made in the same way and with the same kind of machines as in the United States, the German tanner has methods of manufacture that sometimes require certain special machinery not found in American tanneries.

TRADE IN TANNING MATERIALS.

Leather was formerly tanned in Germany with oak and pine barks; later valonia and sumac were used. Quebracho has been employed for about 30 years, being imported in large quantities, principally in the log. Divi-divi is used largely in the tanning of sole leather after the North German system. Mimosa bark has been used for about 20 years, while mangrove bark, which is now consumed in moderately large quantities, was introduced at a comparatively recent date; that of East and South African origin is preferred.

Of extracts, chestnut extract was the first used to a considerable extent in Germany; extract of oak was adopted soon afterwards. Quebracho extract is largely manufactured in the country, being the principal product of the German tanning-extract factories. It is estimated that Germany supplies perhaps one-fifth of its total demand for tanning materials. Although it has large tan-oak forests, considerable quantities of oak bark are imported annually; this is also true as regards pine bark. The quantity and value of Germany's imports and exports of tanning materials in 1909 and 1910 are shown in the following table:

Articles.	Quantity.		Value.	
	1909	1910	1909	1910
IMPORTS.				
	<i>Pounds.</i>	<i>Pounds.</i>		
Oak bark.....	94,550,060	85,985,460	\$1,033,872	\$940,100
Pine and similar barks.....	75,165,200	71,951,000	539,546	509,558
Acacia and other tanning barks.....	54,181,160	83,370,980	1,075,284	1,572,942
Quebracho and other tanning wood:				
In blocks.....	205,561,180	310,333,760	1,823,556	2,738,594
Split up.....	8,903,840	6,412,120	91,630	65,926
Gall nuts.....	5,804,040	6,374,160	631,890	708,526
Myrobolans.....	28,977,080	37,494,380	414,120	543,830
Catechu.....	7,611,120	9,491,020	421,706	517,174
Divi-divi.....	16,099,820	14,016,500	405,314	350,574
Sumac.....	7,822,540	7,902,180	227,052	205,632
Acorns.....	4,096,840	1,204,280	112,336	39,508
Algarovilla, valonia, and other tanning material.....	32,769,660	52,555,360	772,072	1,224,986
Total.....	541,542,540	687,091,200	7,548,378	9,417,350
EXPORTS.				
Oak bark.....	2,408,120	1,845,140	41,650	17,374
Pine and similar barks.....	1,096,040	1,088,780	9,996	8,806
Acacia and other tanning barks.....	4,425,960	4,933,280	86,870	97,104
Quebracho and other tanning wood:				
In blocks.....	519,200	.....	32,368	.....
Split up.....	24,655,400	23,792,340	290,780	288,632
Gall nuts.....	11,440	82,280	0,664	13,080
Myrobolans.....	88,220	23,760	3,332	952
Catechu.....	246,620	526,240	31,416	54,978
Divi-divi.....	2,860	2,200	1,904	1,190
Sumac.....	303,600	492,580	8,806	15,946
Acorns.....	212,080	62,920	3,332	2,142
Algarovilla, valonia, and other tanning material.....	551,320	295,460	16,422	13,080
Total.....	34,520,860	33,144,980	539,546	513,604

Exports of tanning materials are small in comparison with imports. The largest single item is split quebracho and other tanning woods, of which, in 1910, Russia took 10,389,060 pounds, Austria-Hungary 8,404,660 pounds, and Sweden 4,998,620 pounds. Of other exports, oak bark went to Belgium and Switzerland, pine and similar barks to Austria-Hungary and Belgium, acacia and other tanning barks and gall nuts to Russia and Austria-Hungary, myrobolans to Norway and Portugal, catechu to Netherlands and Sweden, divi-divi to Norway and the United Kingdom, sumac to Austria-Hungary and Switzerland, acorns to Austria-Hungary and Belgium, and algarovilla, etc., to Russia and Norway.

SOURCE OF TANNING MATERIALS.

The source of Germany's imports of tanning materials is shown in the following table:

Articles and countries.	1909	1910	Articles and countries.	1909	1910
Oak bark:	<i>Pounds.</i>	<i>Pounds.</i>	Myrobolans:	<i>Pounds.</i>	<i>Pounds.</i>
Austria-Hungary.....	60,500,000	53,336,800	British Indies.....	28,428,840	36,210,900
Belgium.....	8,884,700	6,671,280	Dutch Indies.....	548,240	1,283,490
France.....	19,727,400	20,083,700	Total.....	28,977,080	37,494,390
Netherlands.....	5,437,960	5,853,680			
Total.....	94,550,060	85,985,460	Catechu:		
			British Indies.....	5,341,380	3,820,530
Pine and similar barks:			Dutch Indies.....	629,200	612,930
Austria-Hungary.....	71,966,620	69,067,020	Malacca.....	1,640,540	5,057,580
Sweden.....	3,198,580	2,883,980	Total.....	7,611,120	9,491,030
Total.....	75,165,200	71,951,000			
			Divi-divi:		
Acacia and other tanning barks:			Colombia.....	9,029,460	4,599,320
Australia.....	7,263,520	13,300,320	Dutch Guiana.....	997,920	1,636,360
British Africa.....	36,886,740	47,928,100	Venezuela.....	6,072,440	7,780,530
British Indies.....	577,500	3,967,920	Total.....	16,099,820	14,016,500
German East Africa.....	2,302,740	2,974,180			
Madagascar.....	7,150,660	15,200,460	Sumac:		
Total.....	54,181,100	81,370,980	Austria-Hungary.....	1,586,640	1,006,060
			Italy.....	6,235,900	6,886,120
Quebracho and other tanning wood, in block: Argentina.....	205,561,180	310,333,760	Total.....	7,822,540	7,902,180
Quebracho and other tanning wood, split up:			Acorns:		
Belgium.....	8,811,000	6,301,460	Belgium.....	2,889,920	762,060
Netherlands.....	92,840	110,660	Netherlands.....	1,206,920	442,200
Total.....	8,903,840	6,412,120	Total.....	4,096,840	1,204,260
Gall nuts:			Algarovilla, valonia, and other tanning materials:		
China.....	5,006,540	5,561,040	Austria-Hungary.....	2,064,040	2,981,220
Turkey.....	797,560	813,120	British Indies.....	38,560	25,530
Total.....	5,804,040	6,374,160	Chile.....	6,600	925,320
			Greece.....	3,685,000	1,280,420
			Turkey.....	26,975,520	47,333,880
			Total.....	32,760,660	52,555,360

CHARACTER OF OUTPUT—SOLE LEATHER.

Practically every kind of leather is produced, although certain centers are noted for certain kinds of leather. The industry formerly centered largely near the sources of tanning materials, especially in the rich oak districts, as well as near a plentiful supply of water—Malmedy, Alsace Lorraine, Wurttemberg, etc.

While still carried on in these districts and the smaller central German States, the sole-leather industry has developed a more important center in and around Hamburg. Quebracho tanning has increased extensively in Hamburg, Wandsbek, Altona, Stellingen, Lagenfeld, Kellinghusen, Stade, Elmshorn, Itzehoe, and Neumunster. The products of these districts, tanned by the rapid-tanning system (extracts principally), are well known on the world's markets as North German sole leather. The North German tanners, generally speaking, are perhaps the most progressive. The industry is least progressive in East Germany. In the Rhine district and in Schleswig-Holstein extensive development has taken place, although the oak-bark or long-tannage system prevails.

Two distinct kinds of sole leather are made in Germany, one called "vacheleder," which is tanned with extracts for light wear, and the other termed "soleleder," used for army boots and heavy wear. The latter leather requires six months and upward for tannage, while the former is tanned in three to six weeks. A third method, a combination of these two, is also employed for tanning sole leather.

Among the largest sole-leather tanners may be mentioned the following firms: Lederfabrik Hirschberg, Knoch & Co., Hirschberg, with a weekly production of 8,000 hides; Lederwerke Wiemann A. G., Hamburg, 5,000 hides; Norddeutsche Lederfabrik, G. m. b. H., Stade, 3,000 hides; Lederwerke Neustadt, Mecklenburg, 3,000 hides.

Charging with chemicals leather that is sold by weight is not allowed in Germany; heavy extracts are sometimes used, however, to obtain a better yield.

UPPER LEATHER—HARNESS AND GLOVE LEATHER.

Chrome upper leather is manufactured in large quantities and in practically all parts of the Empire. The principal and larger firms are producing it on exactly the same lines as the American tanners; they use the same tanning process, and as previously stated, the same machines. The following are the important upper-leather tanners:

Firm name and address.	Output.
Cornelius Heyl, Worms.....	2,000 dozen calfskins, 150 dozen glazed kid, and 1,500 sides enameled leather daily.
Carl Freudenberg, Weinheim.....	1,500 dozen calfskins daily.
J. Mayer & Sohn, Offenbach on the Main.....	1,500 dozen glazed kid daily, also patent colt.
Hermann Sager, Neumunster.....	6,000 East Indian kips daily.
Emil Kötter, Neumunster.....	1,000 dozen sheepskins daily.
Doerr & Reinhardt, Worms.....	Patent leather, box calf, and glazed kid.
Carl Simon Söhne, Kirm on the Nahe.....	Glazed kid (semichrome).
Heinrich Bierling, Dresden.....	Box calf.
Deutsch-Amerikanische Lederwerke (Becker & Co.), Bursfelde.....	Box side leather.
Adler & Oppenheimer, Zingolshelm.....	All kinds of upper leathers, also sole and belting.
Sigmund Hirsch, Weinheim.....	Horsehides.

There is still a large demand in this country for bark-tanned upper leather, particularly for the Army and for the rural population. The raw materials employed for these leathers are cowhides, East Indian kips (worked mainly in Wurttemberg, Thuringia, and Holstein), calfskins (worked in the south of Germany), and horsehides. The latter, while not used nearly so extensively as formerly, are still worked to a certain extent in the south of Germany and in Holstein.

Split hides for bag leather are tanned and curried principally in the Province of the Rhine, the largest center being Mulheim on the Rhur. The principal tanners of bag leather are August Jaeger, Bonn; H. Coupienne, Mulheim on the Rhur; Z. Spier, Wickrath. Each of these firms also makes a high-grade japanned leather. Harness leather is manufactured in many towns, some of the principal manufacturers being C. F. Roser, Esslingen; J. H. Roser, Feuerbach-Stuttgart; Gebrüder Steinlein, Berlin; D. Römer, Berlin.

Vegetable-tanned sheepskins are used for many purposes and are tanned principally at Kirchhain (Brandenburg) and Neumark. Sheepskins are curried and finished near Frankfort on the Main and

in Thuringia. Glove leather is manufactured in large quantities, the principal centers of production being Burg, Magdeburg, Berlin, Brandenburg, Hainau, Munich, and Esslingen.

WAGES—TRADE SCHOOLS.

The cost of raw materials is about the same as in the United States. Wages vary, being influenced to a great extent by the location of the tannery; probably the highest are paid in the mining district near the Rhine. Unskilled labor (male) is paid \$4.30 to \$6.20 per week; skilled labor (male) from \$5.70 to \$7.15 and upward; female labor from \$2.85 to \$3.55. Piecework is the rule in most German tanneries, and I am informed that a man often earns from \$7.15 to \$11.90 per week, according to his skill.

Following are the actual amounts paid for certain piecework: Beamster, for fleshing large hide by hand, in Province of the Rhine, 7.14 cents; in other parts of Germany, 4.3 to 5.7 cents; machine shaver for shaving chrome calfskin or side, 1.07 cents; machine glazer, according to size of skin, 0.24 to 0.95 cent per skin; hand boarder, per hide, 0.7 to 2.85 cents. The handwork on a square foot of box calf is estimated, in one of the largest tanneries, at 6.43 cents, but this figure may be raised to 9.52 cents for smaller establishments.

Other actual prices paid in a chrome-leather tannery follow: Shaving calfskins or large sheepskins, \$1.07 to \$1.19 per 100 skins; first glazing, 14.3 cents per 100 skins; second glazing, 21.4 cents; third glazing, 28.6 cents; fleshing by machine (at a rate of 300 skins per hour), 4.8 cents per 100 skins.

Technical education, an important factor in German industrial life, is available for all branches of the industry. There may be specially mentioned the German Tanners School at Freiberg, Saxony, established in 1889, which gives theoretical and practical instruction in the tanning trade and also provides the general commercial and technical training necessary for carrying on the tanning industry. About half of the students are German and the remainder foreign. Other schools are the German Experimental Station for the leather industry, also at Freiberg; the institution at Metzingen, Wurttemberg, and the Shoemakers' Professional School at Siebenlehn, Saxony, which affords theoretical and practical training in all phases of the industry from the manufacture of a handmade boot or shoe to the management of a modern shoe-manufacturing plant.

LEATHER TRADE.

Much of the German leather trade was formerly transacted at leather fairs held in various towns, those of Frankfort and Leipzig being most important. These fairs are still held at intervals in the two towns named and also in Allenstein, Brunswick, Breslau, Cassel, Frankfort on the Oder, Hanover, Heilbronn, Kirchhain, Neustadt on the Orla, Stuttgart, and Ulm, but the transactions are far less important than formerly. Leather is now sold to the consumer direct, and through commission agents and wholesale dealers, also on the exchange at Hamburg. The quantity and value of Germany's imports and exports of leather in 1909 and 1910 are shown in the following table:

Articles.	Quantity.		Value.	
	1909	1910	1909	1910
IMPORTS.				
Leather, half or wholly dressed, not further prepared:	<i>Pounds.</i>	<i>Pounds.</i>		
Sheep and lamb skins.....	4,913,260	6,096,760	\$3,641,400	\$4,500,818
Goat and kid skins.....	3,196,100	3,645,840	2,702,966	3,067,824
Upper leather for boots, shoes, and slippers.....	312,620	538,780	551,694	857,276
Leather, tanned, dressed, and finished:				
Sole leather.....	2,504,700	2,535,060	1,206,660	1,067,672
Leather belting.....	1,507,660	1,466,080	688,058	680,870
Leather for harness, furniture, pocketbooks, etc.....	102,960	128,480	145,894	137,068
Glove leather, including glazed, reindeer, wash leather, etc.....	44,660	49,500	116,382	121,380
Goat and kid leather, except glove and patent.....	716,100	861,060	1,705,944	2,053,424
Sheep and lamb leather, except glove and patent.....	2,007,060	2,239,160	2,451,757	2,606,346
Patent calf.....	15,180	15,840	60,690	53,550
Patent cow, goat, sheep, etc.....	89,540	150,920	161,602	260,848
Artificial leather made from leather by-products.....	3,520	15,400	476	1,428
Other leather.....	103,400	101,860	109,718	139,944
Total.....	15,516,760	17,843,760	13,543,231	15,527,468
EXPORTS.				
Leather, half or wholly dressed, not further prepared:				
Sheep, lamb, goat, and kid skins.....	120,560	103,620	146,370	72,352
Upper leather for boots, shoes, and slippers.....	18,170,880	18,206,660	19,485,536	20,440,154
Leather, tanned, dressed, and finished:				
Sole leather.....	9,692,720	10,905,020	2,023,476	2,664,648
Leather belting.....	88,420	105,160	101,626	129,710
Leather for harness, furniture, pocketbooks, etc.....	2,344,540	2,462,360	1,863,778	2,097,494
Glove leather, including glazed, reindeer, wash leather, etc.....	1,569,700	1,398,100	3,054,254	3,015,460
Goat and kid leather, except glove and patent.....	3,243,460	3,447,180	6,371,736	6,926,514
Sheep and lamb leather, except glove and patent.....	1,158,960	1,466,540	1,478,218	1,850,926
Patent calf.....	2,468,020	3,185,720	4,105,738	5,212,438
Patent cow, goat, sheep, etc.....	1,512,060	2,055,460	1,912,230	2,917,642
Artificial leather made from leather by-products.....	91,960	127,820	27,846	33,320
Other leather.....	122,100	115,310	276,794	276,060
Total.....	40,563,420	43,608,950	40,847,602	45,636,738

The foregoing shows that the exports are nearly three times the value of the imports. The latter increased from \$13,543,231 in 1909 to \$15,527,468 in 1910, while during the same period the exports increased from \$40,847,602 to \$45,636,738.

LEATHER TRADE WITH PRINCIPAL COUNTRIES.

The quantity of leather imported from and exported to the principal foreign countries is shown in the following:

Articles and countries.	1909	1910	Articles and countries.	1909	1910
IMPORTS.			IMPORTS—continued.		
Sheep and lamb skins, half or wholly dressed:			Sheep and lamb leather, dressed and finished, except glove and patent:		
Austria-Hungary.....	<i>Pounds.</i> 39,380	<i>Pounds.</i> 64,900	Belgium.....	<i>Pounds.</i> 164,340	<i>Pounds.</i> 157,960
Belgium.....	47,300	44,000	France.....	1,252,020	1,411,520
British India.....	716,320	734,360	United Kingdom.....	564,740	621,500
France.....	1,315,600	1,676,620	United States.....	25,960	46,180
Netherlands.....	22,880	42,340	Total.....	2,007,060	2,239,160
Spain.....	38,280	67,760			
United Kingdom.....	2,733,500	3,464,780	Patent calf:		
Total.....	4,913,260	6,095,760	United Kingdom.....	6,000	8,300
Goat and kid skins, half or wholly dressed:			United States.....	8,580	7,490
British India.....	2,559,640	2,587,640	Total.....	15,180	15,840
France.....	195,140	113,520			
United Kingdom.....	441,320	944,680	Patent cow, goat, sheep, etc.:		
Total.....	3,196,100	3,645,840	United Kingdom.....	72,380	101,200
Upper leather for boots, shoes, and slippers:			United States.....	17,160	49,720
Austria-Hungary.....	42,680	31,240	Total.....	89,540	150,920
France.....	11,220	39,380			
Netherlands.....	5,720	35,640	Artificial leather made from leather by-products:		
United Kingdom.....	117,700	152,240	France.....	3,300	5,500
United States.....	135,300	280,280	United Kingdom.....	220	9,900
Total.....	312,620	538,780	Total.....	3,520	15,400
Sole leather:			Other leather:		
Chile.....	1,980,000	1,818,960	Austria-Hungary.....	3,960	3,520
France.....	57,860	42,680	France.....	1,100	10,340
Russia.....	37,620	31,900	Russia.....	35,640	36,740
United Kingdom.....	429,220	641,520	United Kingdom.....	24,640	28,600
Total.....	2,504,700	2,535,060	United States.....	38,060	22,660
Leather belting:			Total.....	103,400	101,860
Belgium.....	1,063,700	1,066,340			
United Kingdom.....	443,960	399,740	EXPORTS.		
Total.....	1,507,660	1,466,080	Sheep, lamb, goat, and kid skins, half or wholly dressed:		
Leather for harness, furniture, pocketbooks, etc.:			Austria-Hungary.....	52,800	59,400
Japan.....	39,160	54,120	United Kingdom.....	67,760	44,220
United Kingdom.....	63,800	74,360	Total.....	120,560	103,620
Total.....	102,960	128,480			
Glove leather, including glazed, reindeer, etc.:			Upper leather for boots, shoes and slippers:		
Austria-Hungary.....	21,560	21,560	Austria-Hungary.....	2,931,720	3,651,120
France.....	9,020	16,500	Belgium.....	655,360	500,780
Russia.....	14,060	11,440	Denmark.....	398,640	464,200
Total.....	44,660	49,500	France.....	1,481,040	1,299,960
Goat and kid leather, dressed and finished, except glove and patent:			Italy.....	1,857,680	1,787,500
Austria-Hungary.....	16,060	15,620	Netherlands.....	667,260	535,480
France.....	153,340	187,880	Norway.....	306,020	324,200
Netherlands.....	30,360	48,620	Roumania.....	272,800	234,060
United Kingdom.....	53,240	57,640	Russia.....	2,001,780	2,185,040
United States.....	463,100	561,320	Sweden.....	644,600	649,440
Total.....	716,100	861,080	Switzerland.....	2,028,180	2,127,180
			United Kingdom.....	3,168,880	2,594,900
			United States.....	123,860	130,680
			All other countries.....	1,653,060	1,654,080
			Total.....	18,170,890	18,266,660

Articles and countries.	1909	1910	Articles and countries.	1909	1910
EXPORTS—continued.			EXPORTS—continued.		
Sole leather:	<i>Pounds.</i>	<i>Pounds.</i>	Sheep and lamb leather, dressed and finished, except glove and patent:	<i>Pounds.</i>	<i>Pounds.</i>
Austria-Hungary.....	168,520	229,460	Austria-Hungary.....	491,040	557,060
Denmark.....	409,640	417,400	Brazil.....	73,920	113,520
France.....	457,380	776,160	Italy.....	72,600	83,160
Netherlands.....	1,487,640	2,110,680	Russia.....	174,460	305,800
Switzerland.....	1,860,700	2,562,780	Sweden.....	67,320	104,940
United Kingdom.....	4,464,900	3,768,820	United Kingdom.....	73,260	97,460
All other countries.....	843,920	1,039,720	United States.....	40,480	22,000
Total.....	9,602,760	10,905,020	All other countries.....	165,880	182,600
Leather belting:			Total.....	1,158,960	1,466,540
Russia.....	20,680	40,920	Patent calf:		
United Kingdom.....	47,740	64,240	Argentina.....	84,280	132,220
Total.....	68,420	105,160	Australia.....	66,220	71,280
Leather for harness, furniture, pocketbooks, etc.:			Austria-Hungary.....	293,700	287,320
Austria-Hungary.....	638,460	738,700	Belgium.....	70,840	90,200
France.....	299,860	178,860	Brazil.....	52,580	92,180
Italy.....	287,980	315,480	France.....	259,380	244,200
Russia.....	352,000	386,540	Italy.....	111,760	162,920
Switzerland.....	220,680	282,480	Russia.....	216,480	444,180
United Kingdom.....	165,440	162,360	Turkey.....	159,280	150,260
All other countries.....	382,140	407,880	United Kingdom.....	472,120	905,520
Total.....	2,344,540	2,492,360	United States.....	135,360	95,920
Glove leather, including glazed, reindeer, etc.:			All other countries.....	546,040	509,520
Austria-Hungary.....	324,720	349,580	Total.....	2,468,020	3,185,720
Denmark.....	62,700	58,080	Patent cow, goat, sheep, etc.:		
Russia.....	96,800	134,040	Austria-Hungary.....	199,540	223,520
United Kingdom.....	109,780	121,440	France.....	151,800	117,920
United States.....	948,860	661,540	Italy.....	122,980	126,760
All other countries.....	26,840	72,820	Portugal.....	50,380	60,960
Total.....	1,560,700	1,398,100	Russia.....	769,780	1,203,620
Goat and kid leather, dressed and finished, except glove and patent:			United Kingdom.....	75,900	146,520
Argentina.....	71,720	88,440	All other countries.....	141,680	171,160
Austria-Hungary.....	323,180	364,760	Total.....	1,512,000	2,055,460
Belgium.....	162,580	171,820	Artificial leather made from leather by-products:		
Brazil.....	140,160	123,420	Argentina.....	69,300	84,700
Denmark.....	77,000	83,940	Switzerland.....	22,660	43,120
France.....	194,700	161,480	Total.....	91,960	127,820
Italy.....	278,300	279,180	Other leather:		
Roumania.....	198,660	164,120	Austria-Hungary.....	37,680	25,550
Russia.....	611,380	881,700	Belgium.....	1,540	1,540
Sweden.....	116,820	166,100	France.....	43,780	39,380
United Kingdom.....	540,100	440,880	Italy.....	6,820	16,500
United States.....	73,920	80,300	Switzerland.....	32,340	32,340
All other countries.....	445,940	430,980	Total.....	122,100	115,310
Total.....	3,243,460	3,447,180			

MARKET FOR AMERICAN LEATHER.

Germany is making strenuous efforts to increase its export trade in leather as well as to supply home demands. Nevertheless certain American leathers find a good market in this country. American calfskins, which were sold here in large quantities 10 years ago, have been supplanted almost entirely by German leathers, which have been gradually improved to compete with the American product; furthermore, they are favored because of the greater care and uniformity in assortment.

Importers state that they occasionally sell American chrome calf. American side leather has lost its former position in the German market on account of (1) high prices, due to the advance in prices of hides, and (2) the customs duty, which was considerably advanced in 1906. The only side leather of American origin now sold here is patent leather, for which there is a constantly increasing demand. According to United States statistics, exports of patent or enameled leather from the United States to Germany were valued at \$390, \$652, \$1,882, \$5,130, and \$91,926 for the fiscal years 1907, 1908, 1909, 1910, and 1911, respectively. The sale of American splits has ceased almost entirely, owing to the high duty, which has made prices prohibitive.

American glazed kid finds a good market here and sales are increasing. The best lines of American kid are still superior in quality to German makes. The principal German kid competing is that tanned by Mayer, at Offenbach; in calfskins, Heyl, Freudenberg, and Doerr & Reinhardt are the main competitors. Competition in patent sides is also largely with the Heyl brand.

Preference is often given German leathers because German tanners, who greatly fear American competition, are giving very close attention to the requirements of their customers and are filling orders with all possible promptness. French glazed kid is cheaper, but it is admittedly not so good as the American. Prices, however, are so dependent upon quality and grading that to attempt comparisons would be misleading. The outlook for American glazed kid and side patent leathers is very good and sales of both lines can be increased materially if American manufacturers exercise more care in filling orders and live up to contracts so far as concerns date of delivery.

European firms offer long credits. The larger importers of leather do not object, however, to paying against documents, but they do complain severely regarding deliveries. Four weeks from date of shipment is the time ordinarily allowed for delivery from the United States, as against three to eight days in Germany. It is stated, however, that the four-week period is often extended indefinitely by the majority of American leather exporters, who apparently fill German orders at their own convenience, with small regard for living up to contracts.

BOOT AND SHOE TRADE.

Although there has been marked development in the domestic industry and Germany's exports of boots and shoes now exceed in value its imports, the market for American shoes is a considerable one, and may, I believe, be further increased notwithstanding certain unfavorable circumstances. Germany's exports are articles of cheaper grade; imports are almost entirely high-class footwear. Imports were valued at \$2,036,804 in 1910, against \$1,933,750 in 1909, while exports were \$2,732,478 in 1910 and \$2,284,324 in 1909. The quantity of the imports and exports, by countries, is shown in the following table:

Countries.	1909	1910
IMPORTS.		
	<i>Pounds.</i>	<i>Pounds.</i>
Austria-Hungary.....	674,960	621,280
France.....	40,040	51,480
Netherlands.....	29,480	44,440
Switzerland.....	121,000	138,600
United Kingdom.....	137,280	166,320
United States.....	322,740	367,840
Total.....	1,225,500	1,389,960
EXPORTS.		
Austria-Hungary.....	208,940	302,220
Denmark.....	423,060	381,260
Finland.....	159,500	153,340
France.....	144,960	146,080
German Southwest Africa.....	106,700	168,960
Netherlands.....	54,340	38,500
Russia.....	17,380	20,460
Switzerland.....	853,380	1,026,740
United Kingdom.....	57,640	51,480
Total.....	2,020,920	2,289,100

COMPETITION AMERICAN SHOES MEET.

Purchases from Austria-Hungary far exceed in weight those from the United States. Footwear of Austro-Hungarian origin includes chiefly articles for ladies' wear, especially boots and shoes in lighter weights, house slippers, and dress footwear. In other than these special lines, the American exporter does not encounter very keen competition from other foreign countries. More competition is met among certain German manufacturers who are now producing lines of higher-class goods, although the number of manufacturers whose products may claim to vie with the grades and classes imported from the United States is very limited.

There is no market in Germany for the cheaper grades of American boots and shoes, trade in which line is supplied by the constantly increasing production of domestic factories, at retail prices so low that American competition is out of the question. Only the better grades of footwear should be sent to this country, the demand for

American products being found among the upper classes and more largely among the young men and young women than the middle-aged or older people. The various novelties in ladies' goods imported each season find ready buyers in the "society set." As regards styles, it may be stated that possibly 40 per cent of the so-called more up-to-date shapes, that is, styles sold as "latest" in New York, are popular here, but the bulk of the trade is done in footwear built on lasts specially designed.

The trade is chiefly in men's and women's goods; the high price of children's American-made shoes as compared with the domestic product constitutes a great drawback to their sale. Nearly all leathers find sale, including box calf, vici kid, patent colt, and patent calf, but vici kid is most popular. Some kangaroo and suede leathers are also sold. Black is by far the best selling color, although tans enjoy a certain popularity during summer months. Sizes and widths should run from medium to large and broad, D and E widths being good sellers. The retail prices of American boots and shoes range from 16.50 to 30 marks (\$3.93 to \$7.14) per pair for men's and women's, and from 10.50 to 15 marks (\$2.50 to \$3.75) for children's sizes 7 to 13.

PROSPECTS FOR AMERICAN TRADE.

As regards the outlook, American boots and shoes for adults are to-day in good favor and in good demand. Whether this will continue, or increase, or whether our footwear is now at the height of its popularity is a mooted question. I am inclined to believe, after interviews with dealers in various parts of the Empire, that we may continue not only to hold our own, but also to enjoy a normal growth in sales.

The shoe trade in Germany is now, as a whole, in excellent condition, due chiefly to a freer expenditure of money by the people. A few years ago, I am told, it was customary among different classes to have footwear resoled, often more than once. This practice of course lessened the output and actual turnover by manufacturers, but increased the cobbling shoemakers' trade. To-day the better classes are, it is stated, buying pair for pair as many shoes as the American consumer. This change in conditions has been of great benefit to shoe manufacturers, the output of German factories in some cases being doubled.

The average grade of German-made boots and shoes for adults is popularly priced in all styles at 12.50 marks (\$2.97) per pair. German-made footwear competing with imported goods is retailed at 15.50 and 18.50 marks (\$3.69 and \$4.40). Custom and to-order goods are sold up to 30 marks (\$7.14) per pair.

Competing English lines retail at prices ranging from 12.50 to 25 marks (\$2.97 to \$5.95) per pair. Very small quantities are sold at 20 marks (\$4.76) and upward, in proportion to the amount of business done. English-made tennis shoes are in good demand, and sporting-goods stores as a rule carry English-made football shoes.

The more important retailers of American footwear in Germany obtain stocks direct from the manufacturer in the United States. The majority of the smaller retail dealers place orders through commission agents, from whom small or large quantities can be obtained. It would seem that the American manufacturer not

already established here can hardly expect to obtain a considerable business other than through an exclusive agency, or the establishment of his own retail stores.

Trade in American shoe polishes is very small, as they are higher in price than the German and English. Moreover, the American manufacturer sends polishes marked in English text, whereas those of British make have the text printed in German. The quality of the British polishes is excellent, foremost among them being the Nugget Shoe Polish and Meltonian Cream. The Nugget Polish Co. has an office and a warehouse in Frankfort on the Main.

APPENDIX.

GERMAN SHOE MANUFACTURERS.

PIRMASENS DISTRICT.

Names of firms.	Pairs per week.	Class of work.
PIRMASENS.		
J. Adolf.....	3,600	Men's, women's, girls', and children's McKay sewn.
A. Bayerdorf.....	600	Girls' and children's McKay sewn.
L. Bayerdorf.....	1,200	Women's, girls', and children's McKay sewn.
F. Bechtold.....	1,200	Men's, women's, girls', and children's McKay sewn.
Bleiching & Co.....	2,700	Women's, girls', and children's McKay sewn and turns.
L. Bleiching.....	600	Girls' and children's turns (handwork).
L. Bock.....	3,600	Men's and women's McKay sewn.
C. L. Breith.....	1,200	Do.
K. Bucholz.....	4,800	Do.
Bueckhardt & Zell.....	4,800	Do.
J. Broschart.....	1,200	Women's, girls', and children's McKay sewn.
Buech & Loeser.....	4,800	Women's McKay sewn.
Christmann & Co.....	600-1,000	Men's and women's McKay sewn.
L. Däufel.....	1,200	Men's, women's, girls', and children's McKay sewn.
Dehmer & Höreth.....	3,600	Men's and women's McKay sewn and Goodyear welt.
Chr. Diehl.....	3,600	Men's and women's McKay sewn.
F. Döring.....	600-1,000	Do.
H. Drehsaupt.....	600-1,000	Do.
Drexler & Co.....	3,600	Men's, women's, girls', and children's McKay sewn and turns.
K. I. Eckert.....	600	Women's McKay sewn.
A. Faul.....	600	Do.
G. Faul, jr.....	960	Women's, girls', and children's McKay sewn.
A. Frank.....	600	Girls' and children's McKay sewn.
Frey & Gärtner.....	600	Women's, girls', and children's McKay sewn.
P. Faul.....	600	Girls' and children's McKay sewn.
E. Gans.....	360	Do.
H. Gaubatz.....	1,200	Women's, girls', and children's McKay sewn.
A. Gaubatz.....	850-1,000	Do.
Chr. Gemeinder.....	2,400	Men's, women's, girls', and children's McKay sewn.
Griesser & Lang.....	1,800	Men's and women's Goodyear welt and McKay sewn.
G. Gross.....	600	Women's McKay sewn.
Chr. Haber.....	1,200	Men's, women's, girls', and children's McKay sewn.
Haber & Co.....	1,200	Women's, girls', and children's McKay sewn.
Gg. Hartmann.....	600-1,000	Men's and women's McKay sewn.
Fr. K. Heil.....	1,200	Women's McKay sewn.
L. W. Heinrich.....	600-1,000	Men's and women's McKay sewn.
H. Hill.....	3,600	Men's Goodyear welt and McKay sewn.
K. Hoch.....	1,800	Men's, women's, girls', and children's McKay sewn.
Hh. Hoffmann.....	1,200	Men's and women's McKay sewn.
Paul Hüttig.....	600	Do.
H. Ihle.....	600-1,000	Do.
Gg. Iitt.....	1,200	Men's, women's, girls', and children's McKay sewn.
Junge & Rothaar.....	600	Do.
P. Kaiser.....	3,600	Do.
Kaiser & Co.....	7,200	Do.
Kilian & Schuck.....	1,800	Women's, girls', and children's McKay sewn.
J. Kaufmann, jr.....	960	Do.
Chr. Klein.....	600	Women's McKay sewn.
H. Klesmann.....	2,400	Men's, women's, girls', and children's Goodyear welt and McKay sewn.
Klesmann Gebr.....	1,200	Men's, women's, girls', and children's McKay sewn.
L. F. Klesmann.....	600	Women's, girls', and children's McKay sewn.
Ludw. Klesmann.....	600	Do.
W. Kling.....	960	Do.
Chr. Kling.....	1,200	Men's, women's, girls', and children's McKay sewn.
P. König.....	2,400	Do.
Ludw. Kopp.....	9,600	Men's and women's Goodyear welt and McKay sewn.
L. Kaufmann.....	600-1,000	Men's and women's McKay sewn.
L. Knerr.....	600-1,000	Do.
Fr. Krummel.....	1,200	Women's, girls', and children's McKay sewn.
Knell & Krautwurst.....	600	Do.
G. Krummet, jr.....	4,800	Do.
Gg. Hoffmann.....	600	Girls' and children's McKay sewn.
Lehnung Gebr.....	1,200	Men's, women's, girls', and children's McKay sewn.
H. Lehnung.....	3,600	Do.
H. Lukes.....	1,200	Women's McKay sewn.
Carl Matz.....	1,200	Girls' and children's McKay sewn.
Fr. Mangold.....	600-1,000	Men's and women's McKay sewn.

German shoe manufacturers—Continued.

PIRMASENS DISTRICT—Continued.

Names of firms.	Pairs per week.	Class of work.
PIRMASENS—continued.		
Fr. Mall.....	600	Women's, girls', and children's McKay sewn.
H. Metzger.....	2,400	Men's and women's McKay sewn.
W. Müller.....	1,200	Women's, girls', and children's McKay sewn.
W. Müller Sohn.....	600	Girls' and children's McKay sewn.
W. H. Müller.....	1,200	Men's, women's, girls', and children's McKay sewn.
Carl Müller.....	600-1,000	Men's and women's McKay sewn.
Chr. Mugler.....	2,400	Do.
G. Neuppert.....	600-1,000	Do.
C. Ohr.....	3,600	Women's, girls', and children's McKay sewn.
Emil Paque.....	12,000	Men's and women's Goodyear welt, McKay sewn, turns, and veldtschoen.
F. Pirmann.....	1,450	Men's and women's McKay sewn.
Preisser Nachf.....	2,400	Men's, women's, girls', and children's McKay sewn.
L. Raber.....	600-1,000	Men's and women's McKay sewn.
P. Reinhardt.....	900	Men's, women's, girls', and children's McKay sewn.
Ed. Rheinberger.....	12,000	Men's, women's, girls', and children's Goodyear welt, McKay sewn, and turns.
Hoh. Rieder.....	960	Men's and women's McKay sewn.
W. Rock.....	1,200	Do.
Ross Gebr.....	1,200	Women's, girls', and children's McKay sewn.
Fr. Roth.....	600	Do.
M. Roth.....	1,200	Men's and women's McKay sewn.
George Röhl.....	600-1,000	Do.
H. Röhl.....	600-1,000	Do.
L. Seibel.....	600-1,000	Do.
L. Bertel.....	600-1,000	Do.
Carl Semler.....	17,000	Men's, women's, girls', and children's McKay sewn.
L. Semler.....	1,200	Do.
Jakob Semler.....	350	Children's McKay sewn.
C. Sedlmeyer.....	480	Women's, girls', and children's McKay sewn.
H. Soffel.....	600	Do.
Chr. Schäfer.....	1,200	Girls' and children's McKay sewn.
L. & J. Schlotter.....	600	Do.
H. Schmenger.....	850	Women's and girls' McKay sewn.
Simon Schmidt.....	850	Women's, girls', and children's McKay sewn.
Fr. Schmidt.....	600	Girls' and children's McKay sewn.
Carl Schmidt.....	600-1,000	Men's and women's McKay sewn.
Chr. Schmidt.....	600-1,000	Do.
Maria Schmidt.....	600-1,000	Do.
A. & G. Schneider.....	2,400	Men's, women's, girls', and children's McKay sewn.
Adam Schwarz.....	960	Women's, girls', and children's McKay sewn.
Franz Schwarz.....	4,800	Men's and women's Goodyear welt and McKay sewn.
Max Schwarz.....	350	Women's McKay sewn.
Theobald & Rosenfelder.....	1,200	Men's, women's, girls', and children's Goodyear welt and McKay sewn.
Thyssen & Heumach.....	600-1,000	Men's and women's McKay sewn.
P. Uhl.....	850	Women's, girls', and children's McKay sewn.
C. Walts Nachf.....	2,400	Men's and women's Goodyear welt, McKay sewn, and turns.
C. Welts.....	960	Women's McKay sewn.
M. Wolf.....	3,600	Men's and women's Goodyear welt, McKay sewn, and turns.
R. & H. Weber.....	1,200	Women's McKay sewn.
H. Wilhelm.....	600-1,000	Men's and women's McKay sewn.
K. Weiss.....	600-1,000	Do.
K. Walter.....	600-1,000	Do.
John Wilhelm.....	600-1,000	Do.
F. Wollmeringer.....	600-1,000	Do.
L. Wolf.....	600-1,000	Do.
C. Zimnecker.....	600-1,000	Do.
L. Zimpler.....	600-1,000	Do.
L. Zimpler, Jr.....	960	Do.
Lambrecht & Weber.....	100	Women's, girls', and children's McKay sewn.
HAUKENSTEIN.		
J. Feith.....	1,200	Men's and women's McKay sewn.
Joseph Hengen.....	1,450	Do.
Jos. Kaiser.....	2,400	Do.
George Kraiss.....	1,800	Do.
Joh. Naab.....	2,400	Men's McKay sewn.
C. A. Seibel.....	3,600	Do.
Stdtdeutsche Schf.....	3,000	Men's and women's McKay sewn.
Gebr. Schwarmüller.....	2,400	Do.
J. Schwarmüller.....	1,200	Do.
Anton Seibel.....	1,800	Men's and women's Goodyear welt and McKay sewn.
Memmer & Co.....	600-1,000	Men's and women's McKay sewn.
Mannsmann Gebr.....	600-1,000	Do.

German shoe manufacturers—Continued.

PIRMASSEN DISTRICT—Continued.

Names of firms.	Pairs per week.	Class of work.
RODALBEN.		
Schmulder & Wagner	600	Girls' and children's McKay sewn.
M. Dauenhauer	600-1,000	Men's and women's McKay sewn.
Frans Durm	600-1,000	Do.
C. Frank Nachf.	600-1,000	Do.
J. Loreth	600-1,000	Do.
Joh. Lelster	600-1,000	Do.
A. Pfundstein	600-1,000	Do.
Max Reber	600-1,000	Do.
J. Servas	600-1,000	Do.
M. Servas	600-1,000	Do.
HELTENBERG.		
Josef Depper	1,200	Women's, girls', and children's McKay sewn.
Fr. Neumayer	1,800	Men's, women's, girls', and children's McKay sewn.
W. Martin	600-1,000	Men's and women's McKay sewn.
Jacob König	600-1,000	Do.
A. Müller	600-1,000	Do.
ZWEIBÜCKEN.		
L. Greiner	1,200	Women's, girls', and children's McKay sewn.
Bremle & Fuohs	1,200	Women's McKay sewn.
Frits Bach	850	Men's and women's McKay sewn.
L. Frowenn	1,450	Men's, women's, girls', and children's McKay sewn.
Joh. Unger	600-1,000	Men's and women's McKay sewn.
OTHER PLACES.		
Maria Ulms, Clausen	600-1,000	Men's and women's McKay sewn.
Carl Backe, Burgalben	600	Women's, girls', and children's McKay sewn.
Peter Schiel, Burgalben	1,200	Girls' and children's McKay sewn.
Fialg & Kalmr, Burgalben	600-1,000	Men's and women's McKay sewn.
Bork & Co., Bileskastal	600-1,000	Do.
J. Brill, Bileskastal	600-1,000	Do.
L. Cronauer, Leimen	1,800	Women's, girls', and children's McKay sewn.
F. N. Cronauer, Leimen	1,800	Do.
Cronauer Gebr., Leimen	600-1,000	Men's and women's McKay sewn.
A. Allspach, Höhrfröchen	1,800	Do.
Gebr. Rund, Höhrfröchen	600	Women's, girls', and children's McKay sewn.
Adam Zeigler, Annweiler	1,200	Do.
J. Boch, Annweiler	600-1,000	Men's and women's McKay sewn.
Chr. Kofer, Kröppen	3,600	Women's, girls', and children's McKay sewn.
Kuns & Weber, Lemberg	600-1,000	Men's and women's McKay sewn.
Kuns & Kästner, Lemberg	600-1,000	Do.
Frau J. Z i m m e r m a n n , Münchweiler	600-1,000	Do.
Marx Wadle, Münchweiler	2,400	Men's, women's, girls', and children's Goodyear welt and McKay sewn.
Josef Wadle, Münchweiler	1,800	Men's, women's, girls', and children's McKay sewn.
Karl Wadle, Münchweiler	1,200	Do.
Genossensch. Schuhfabrik, Lemberg	1,800	Women's, girls', and children's McKay sewn.
Gg. Traxel, Erlenbrunn	1,200	Men's, women's, girls', and children's McKay sewn.
Oskar Klan, Dahn	1,200	Do.
J. Gerlach, Trulben	600	Women's, girls', and children's McKay sewn.
Nik. Wagner, Trulben	600	Do.
Genossensch. Schuhfabrik, Glashütte	600-1,000	Men's and women's McKay sewn.
J. Ganter, Gangreweller	600-1,000	Do.
Hell Gebr., Kapsweyer	600-1,000	Do.
Müller & Schwab, Simten	600-1,000	Do.
Lenhard & Sohn, Neustadt	600-1,000	Do.
R. Stegner, Rieschweiler	1,200	Men's, women's, girls', and children's McKay sewn.
A. Ipser, Niederauerbach	7,200	Men's and women's McKay sewn.
J. Müller Söhne, Speyer	1,800	Men's, women's, girls', and children's Goodyear welt and McKay sewn.
Bernh. Roos, Speyer	1,800	Men's and women's McKay sewn.
Jakob Bauer, Thaleischweiler	3,600	Girls' and children's McKay sewn.
J. Grebast, Thaleischweiler	600-1,000	Men's and women's McKay sewn.
J. Greiner, Thaleischweiler	600-1,000	Do.
K. Rothhaar, Thalfröchen	720	Women's, girls', and children's McKay sewn.
Gg. Sauer, Thalfröchen	3,000	Men's and women's McKay sewn.
Stöss Gebr., Waldfischbach	8,500	Girls' and children's McKay sewn.
O. Oeltzschner, Waldfischbach	2,400	Girls' and children's McKay sewn and turns.
L. Gleich, Waldfischbach	600-1,000	Men's and women's McKay sewn.
Fr. I. Löwenberg, Spirkelbach	600-1,000	Do.
J. Müller, Simten	600-1,000	Do.
C. Ross Nachf., Ixheim	600-1,000	Do.
P. Sandmann, Apostelmühle	600-1,000	Do.
Seibel Gebr., Ertweiler	600-1,000	Do.
Hch. Schäfer, Moschelmühle	600-1,000	Do.
Chr. Stöss, Kröppen	600-1,000	Do.

German shoe manufacturers—Continued.

ERFURT AND WEISSENFELS DISTRICT.

Names of firms.	Pairs per week.	Class of work.
ARNSTADT.		
Hofmann Gebr.....	2,000	Men's and women's McKay sewn and pegged and children's turns.
Bern. Gärber, A. G.....	1,500	Men's, women's, youths', and children's Goodyear welt, McKay sewn, and pegged.
Hullemann & Geck.....	1,200	Men's, women's, youths', and children's McKay sewn and pegged.
F. A. Keil.....	1,500	Men's, women's, youths', and children's Goodyear welt, McKay sewn, and pegged.
E. Wagner.....	1,200	Men's, women's, youths', and children's McKay sewn and pegged.
BURG.		
Dedermann & Homen.....	4,500	Men's, women's, and youths' McKay sewn and pegged.
Aug. Voigt.....	4,000	Do.
Hömen & Co.....	4,000	Do.
A. Krojanker.....	2,000	Men's, women's, youths', and children's McKay sewn and pegged.
C. Tack & Co.....	30,000	Men's, women's, youths', and children's Goodyear welt, McKay sewn, pegged, and veldtschoen.
L. Walter.....	1,200	Men's, women's, and youths' McKay sewn and pegged.
G. Schütz.....	1,000	Men's, women's, youths', and children's McKay sewn and pegged.
ERFURT.		
F. C. Böhmert.....	4,000	Men's, women's, youths', and children's Goodyear welt and McKay sewn.
Carl & Bielschowsky.....	5,500	Do.
F. H. Dotzler.....	600	Men's, women's, youths', and children's McKay sewn and pegged.
Ducke Gebr.....	3,500	Men's and women's Goodyear welt and McKay sewn.
A. Eisfelder.....	900	Women's, youths', and children's McKay sewn.
Erfurter Mech. Schuhfabrik..	4,000	Men's, women's, youths', and children's Goodyear welt and McKay sewn.
M. & L. Hess.....	15,000	Do.
Hofmann & Stenger.....	1,000	Do.
J. Mergenbaum's Nachf.....	2,500	Do.
F. Metzler.....	2,500	Do.
E. Lingel, A. G.....	20,000	Do.
J. A. F. Tieck.....	1,600	Do.
Unseid & Koppe.....	800	Men's and women's Goodyear welt.
WEISSENFELS.		
A. Arsand.....	5,000	Men's, women's, youths', and children's Goodyear welt, McKay sewn, and pegged.
E. Blasig G. m. b. H.....	7,500	Men's, women's, youths', and children's McKay sewn and pegged.
Barnutz & Schenk.....	2,000	Youths' and children's McKay sewn.
Herm. Böhme.....	4,500	Men's, women's, youths', and children's McKay sewn and pegged.
R. Dieck.....	5,000	Do.
H. Holze.....	1,200	Do.
Carl Kühn.....	3,000	Do.
Wilh. Mötz.....	1,500	Men's, women's, youths', and children's Goodyear welt, McKay sewn, and pegged.
H. Schlegel.....	3,000	Men's, women's, youths', and children's McKay sewn and pegged.
E. Pretzsch.....	1,200	Do.
O. Peyerabend.....	2,500	Men's, women's, youths', and children's McKay sewn.
F. W. Schieck.....	1,200	Women's, youths', and children's pegged.
C. Hünigler.....	2,000	Youths' and children's pegged.
A. Landmann.....	2,500	Men's, women's, youths', and children's McKay sewn and pegged.
Ernst Schieck.....	1,500	Women's, and children's McKay sewn and pegged.
G. Kalenowsky.....	1,500	Children's pegged.
G. Mendelsohn.....	1,500	Women's and children's McKay sewn and pegged.
Otto Albert.....	1,500	Children's pegged.
OTHER PLACES.		
Franke & Heeseler, Artern....	1,200	Men's, women's, and girls' Goodyear welt, McKay sewn, and pegged; children's Goodyear welt, and youths' McKay sewn and pegged.
G. Engelhardt & Co., Cassel..	3,000	Men's, women's, youths', and children's Goodyear welt and McKay sewn.

German shoe manufacturers—Continued.

ERFURT AND WEISSENFELS DISTRICT—Continued.

Names of firms.	Pairs per week.	Class of work.
OTHER PLACES—Continued.		
C. & A. Hochhuth, Eschwege.	2,480	Men's, women's, and youths' McKay sewn, and pegged.
Ch. Roet, Eschwege.	2,400	Do.
L. Mensing, Eschwege.	500	Do.
A. Günther's Nachf., Göttingen.	900	Men's, women's, youths', and children's McKay sewn and pegged.
A. Fritsche, Halle on the Saale.	1,800	Men's, women's, and youths' Goodyear welt and McKay sewn.
J. Seyfarth, Ilmenau.	200	Men's, women's, youths', and children's McKay sewn.
H. Mäkel, Kirchberg.	400	Men's, women's, youths', and children's McKay sewn and pegged.
Schreiber & Honer, Mühlhausen.	3,600	Men's, women's, and youths' McKay sewn and pegged.
Bühring & Co., Magdeburg.	5,000	Men's, women's, youths', and children's Goodyear welt and McKay sewn.
E. Charles & Sohn, Oschersleben.	5,000	Women's McKay sewn.
Baumann & Mals, Meerane.	2,000	Men's, women's, youths', and children's Goodyear welt, McKay sewn, and pegged.
Lichsteinstein Gebr., Meerane.	2,500	Men's, women's, youths', and children's McKay sewn and pegged.
Mals & Sohn, Netschkau.	2,000	Men's, women's, youths', and children's Goodyear welt and McKay sewn.
J. G. Schaller & Söhne, Schmolln.	3,000	Men's and women's veldtschoen; also wooden shoes.
Petzold, Pfeiffer & Co., Schmolln.	3,500	Men's, women's, youths', and children's McKay sewn and felt shoes.
Anton Linzen, Weimar.	400	Men's, women's, youths', and children's McKay sewn and pegged.
Carl Hämer, Weida.	1,000	Men's, women's, and children's McKay sewn and felt shoes.
George Kögel, Weida.	800	Men's, women's, youths', and children's Goodyear welt and McKay sewn.
Selle & Co., Weida.	1,000	Men's and women's McKay sewn and felt shoes.
Richter Gebr., Wilkau.	1,000	Men's, women's, youths', and children's Goodyear welt, McKay sewn, and felt shoes.
Aug. Schmidt, jr., Zorbü.	1,200	Men's, women's, and children's Goodyear welt, McKay sewn, and pegged.

STUTTGART DISTRICT.

MÜNCHEN.		
Regensteiner Gebr.	2,800	Men's and women's Goodyear welt and McKay sewn.
S. Letter.	2,400	Men's and women's McKay sewn.
W. Blumgart.	3,600	Men's and women's McKay sewn and felt shoes.
E. & M. Badersdörfer.	4,000	Men's and women's McKay sewn.
R. Wildemann.	1,800	Do.
TUTTLINGEN.		
A. Bartenbach.	600	Men's and women's pegged.
Chr. Binder.	1,000	Do.
Adam Binder.	900	Do.
Karl Binder.	700	Do.
Diehlmann Gebr.	1,500	Men's, women's, and girls' McKay sewn and pegged.
Feinelsen & Hechtle.	600	Men's and women's pegged.
M. Graf Söhne.	800	Do.
Haller & Co.	3,000	Men's, women's, and youths' Goodyear welt, McKay sewn, and pegged.
Fr. Häberle.	2,000	Men's, women's, and youths' pegged.
Gustav Henke.	1,200	Do.
Henke Gebr.	2,400	Men's, women's, and girls' McKay sewn and pegged.
J. Henke Söhne.	1,500	Do.
Karl Henke.	900	Men's and women's pegged.
Jakob Henke.	900	Do.
And. Klalber.	500	Do.
Martin & Mocker.	1,500	Men's, women's, and youths' pegged.
J. G. Martin Söhne.	900	Men's and women's pegged.
Joh. Martin.	800	Do.
J. Martin & Co.	900	Do.
G. W. Martin.	700	Men's, women's, and youths' Goodyear welt, McKay sewn, and pegged.
Lorenz Müller.	400	Men's and women's pegged.
Neipp & Paul.	.....	Men's, women's, and youths' McKay sewn and pegged.
J. G. Reichle.	2,400	Men's, women's, and youths' pegged.
Rieker & Co.	6,500	Men's, women's, and girls' Goodyear welt, McKay sewn, and pegged.

German shoe manufacturers—Continued.

STUTTGART DISTRICT—Continued.

Names of firms.	Pairs per week.	Class of work.
TUTTLINGEN—continued.		
B. Stehle.....	1,800	Men's, women's, and youths' pegged.
J. G. Stengel.....	700	Men's and women's pegged.
Storz & Henke.....	1,800	Men's, women's, and girls' McKay sewn and pegged.
Fr. Trommer & Sohn.....	1,200	Do.
OTHER PLACES.		
Aug. Wessels A. G., Augsburg-Oberhausen.....	50,000	Men's, women's, and girls' Goodyear welt and pegged.
J. Levinger, Augsburg.....	4,500	Men's, women's, and children's veldtschoen.
J. Link & Co., Balingen.....	6,000	Men's and women's McKay sewn and veldtschoen.
C. G. Falkenstein, Balingen.....	1,800	Men's and women's Goodyear welt and McKay sewn.
G. Strassner, Balingen.....	1,800	Men's, women's, and girls' McKay sewn and pegged.
Zeibert & Honer, Backnang.....	1,500	Men's, women's, and girls' Goodyear welt and McKay sewn.
G. Herlinger & Sohn, Bietigheim.....	1,200	Men's and women's McKay sewn and pegged.
Otto Mannal, Bietigheim.....	700	Men's, women's, and youths' McKay sewn and pegged.
Hansen & Co., Cannstatt.....	1,000	Do.
W. Keller, Bisingen.....	15,000	Men's and women's Goodyear welt.
J. Wanner, Böblingen.....	3,600	Men's and women's McKay sewn.
W. Sparr, Beltsen.....	2,400	Men's, women's, and girls' Goodyear welt and McKay sewn.
Krieche Gebr., Bonndorf.....	500	Men's and women's pegged.
J. Döbelmann, Ditzingen.....	800	Men's and women's McKay sewn.
W. Keller, Ebingen.....	1,200	Men's, women's, and youths' McKay sewn and pegged.
Seitz Gebr., Ebingen.....	5,000	Do.
E. Back, Ebingen.....	2,500	Men's and women's McKay sewn and nailed.
L. Strassner, Eggenfelden.....	2,000	Do.
Heller & Hahn, Eggenfelden.....	1,400	Men's and women's McKay sewn and felt shoes.
F. Albert, Eichstätt.....	1,800	Men's and women's McKay sewn, nailed, and felt shoes.
N. Schärer, Emmendingen.....	3,000	Men's and women's McKay sewn and veldtschoen.
Krafft Gebr., Fährhau.....	800	Men's, women's, and youths' McKay sewn and pegged.
M. & S. Levi, Fährhau.....	800	Men's, women's, and girls' McKay sewn and pegged.
Chr. Becker, Friesenhausen.....	6,000	Men's, women's, and youths' McKay sewn and nailed.
R. Wehle, Furt im Walde.....	4,500	Men's, women's, and girls' Goodyear welt and McKay sewn.
J. Eith, Gelsingen.....	4,000	Men's and women's McKay sewn and nailed.
J. Schreiber, Gelsingen.....	2,400	Men's and women's McKay sewn.
Walther & Schluck, Gelsingen.....	1,200	Men's, women's, and girls' Goodyear welt and McKay sewn.
Maute & Hirning, Gammerdingen.....	600	Men's and women's McKay sewn and pegged.
Do.	700	Do.
Moos & Rosenthal, Hechingen.....	600	Men's and youths' pegged.
Dieringer & Spannagel, Hechingen.....	2,800	Men's, women's, and youths' McKay sewn and pegged.
Stigle & Co., Kornwestheim.....	3,600	Men's and women's McKay sewn and felt shoes.
J. Schmalzried, Leonberg.....	30,000	Men's and women's Goodyear welt.
Kümmen & Krauss, Leonberg.....	2,400	Men's, women's, and girls' McKay sewn and pegged.
H. Eyrich, Messkirch.....	1,600	Do.
J. Weill, Mühlhausen E.....	1,800	Men's, women's, and girls' McKay sewn and felt shoes.
Binde Gebr., Neuhausen on the Erms.....	1,500	Men's and women's McKay sewn; also sandals.
J. J. Schlayer, Reutlingen.....	1,500	Men's and women's pegged.
H. Dinkelacker, Sindelfingen.....	1,900	Men's, women's, and girls' Goodyear welt and McKay sewn.
R. J. Mayer, Schwäb. Gmünd.....	1,200	Men's, women's, and girls' Goodyear welt and pegged.
Johannes Heller G. m. b. H., Schwenningen.....	3,200	Do.
Jakob Bürk, Schwenningen.....	2,500	Men's and youths' McKay sewn and pegged.
George Müller, Schwenningen.....	1,000	Men's and women's pegged.
E. Schiele A. G., Stetten/Hoh.....	1,000	Do.
E. Schiele A. G., Fil. Bohl.....	4,200	Men's, women's, and girls' McKay sewn and pegged.
Wolf & Co., Stetten/Hoh.....	2,600	Men's and women's McKay sewn.
Wolf & Co., Fil., Bursiedingen.....	6,000	Men's and women's McKay sewn sandals and slippers.
W. Speiss G. m. b. H., Stuttgart.....	2,600	Men's and women's McKay sewn.
Do.	3,000	Men's, women's, and youths' Goodyear welt.

DÜSSELDORF DISTRICT.

CLEVE.		
Frau H. Jansen.....	400- 500	Children's McKay sewn.
F. Pannier.....	3,000- 3,500	Children's turns (handwork).
	4,000- 5,000	Children's McKay sewn.
	3,000- 3,500	Children's turns (handwork).

German shoe manufacturers—Continued.

DÜSSELDORF DISTRICT—Continued.

Names of firms.	Pairs per week.	Class of work.
CLEVE—continued.		
Van Leyen Gebr.....	2,400-3,000	Children's McKay sewn.
	1,200-1,500	Children's McKay sewn and turns.
	2,500-3,000	Children's turns (handwork).
A. V. Offern Nachf.....	1,500-1,800	Children's McKay sewn and turns (handwork).
	2,000-2,500	Children's turns.
P. Schneitlle & Co.....	1,500-1,800	Children's McKay sewn.
	2,000-2,500	Children's turns.
Frau W. Mittmann	1,500-1,800	Children's McKay sewn.
	2,000-2,500	Children's turns (handwork).
W. Roggmann.....	1,500-1,800	Children's McKay sewn.
	2,000-2,500	Children's turns (handwork).
G. Hoffmann.....	12,000-15,000	Children's McKay sewn.
	4,000-5,000	Children's turns (handwork).
	4,000-5,000	Children's turns.
W. F. Böhmer.....	600	Mens' and youths' Goodyear welt.
	1,800	Mens', women's, and youths' turns.
H. Hunck.....	1,200-1,500	Children's McKay sewn.
	1,500-1,800	Children's turns (handwork).
SCHNEVERDONGEN.		
H. Meyer.....	400-600	Pegged, various.
Pappard & Co.....	800-1,000	Do.
Chr. Röhrs.....	1,000-1,200	Do.
J. H. Maack.....	800-1,000	Do.
F. Schnackenberg.....	1,800-2,100	Do.
W. Loose.....	400-600	Do.
OTHER PLACES.		
J. Döes, Ahaus.....	2,400-2,600	Mens' and women's McKay sewn.
C. Holst, Altona-Ottensen.....	1,800-2,200	Tacked felt shoes.
L. Vogel, Ahweiler.....	1,500-1,800	Children's McKay sewn.
Steinhoff & Hürkamp, Ahlen.....		Mens' and women's pegged.
G. Wirts, Altmühl.....	400-500	Mens' pegged.
J. Tovar, Ahlen.....	900-1,100	Do.
H. Rickert, Barmstedt.....	600-700	Mens' and children's heavy pegged.
Bielefelder Schuhfabrik m. b. H., Bielefeld.....	400-600	Mens' and women's Goodyear welt.
A. Meinert, Bielefeld.....	800-1,000	Mens', women's, and youths' Goodyear welt and McKay sewn.
H. F. Meyer, Bremen.....	1,500-1,800	Mens' and youths' Goodyear welt.
	300-400	Mens' and youths' McKay sewn.
Forst & Pulvermacher, Burscheid.....	600-750	Women's, ball, and patent leather McKay sewn.
L. Frankenstein, Burscheid.....	3,000-3,300	Women's and ball McKay sewn.
	2,500-3,000	Tacked.
J. Bödding, G. m. b. H., Burgsteinfurt.....	500-600	
C. Scheuermann, Bochum.....	1,000-1,200	Felt shoes (prison work).
Rollmann & Mayer, Cöln-Nippes.....	700-800	Ball McKay sewn.
	1,000-1,200	Gymnastic McKay sewn.
	600	Tennis McKay sewn.
	3,000-3,500	Camel's-hair felt shoes.
	4,000-4,500	Veldtschoen (stitchdowns).
Rollman & Engels, Cöln.....	5,000	Ball, gymnastic, etc., McKay sewn.
Pohling & Co., Cöln.....	4,000-5,000	Do.
A. Viereck, Cöln.....	2,500-3,000	Tacked felt shoes.
W. Morsches & Co., Crefeld.....	900-1,100	Mens' and women's McKay sewn.
J. Peters Söhne, Crefeld.....	200-300	Mens' and women's Goodyear welt.
	200-300	Mens' and women's McKay sewn.
P. Wilms, Dalheim.....	2,500-3,000	Do.
P. J. Schmitz, Düsseldorf.....	700	Mens', women's, and youths' Goodyear welt.
	300	Mens', women's, and youths' McKay sewn.
Hassenpflug & Schmidt, Elberfeld.....	300-350	Mens', women's, and girls' Goodyear welt.
	300-350	Mens', women's, and girls' McKay sewn.
E. Peters, Emmerich.....	500-600	Mens' and women's McKay sewn.
J. Krenen, Erkelenz.....	400-600	Mens', women's, and youths' McKay sewn.
W. Sternefeld, Goch.....	4,000-5,000	Mens' and youths' McKay sewn.
J. Völling, Goch.....	1,200-1,500	Do.
J. Nöhlich, Gerderath.....	500-600	Mens', women's, and youths' heavy pegged.
Martin Mendel G. m. b. H., Glückstadt.....	900-1,100	Mens' and youths' heavy pegged.
D. Nordheim, Geldern.....	1,800-1,900	Do.
Carl Cain, Geldern.....	300-350	Mens' and youths' Goodyear welt.
	600-700	Other kinds.
Pigge & Marquard, Hameln.....	10,000-12,000	Tacked felt shoes.
Forst & Pulvermacher, Helsenbrunn.....	1,800-2,100	Mens' and women's McKay sewn.
	600-800	Other kinds.
F. Rinne, Hees, Oldendorf.....	1,000-1,200	
Multhaupt Gebr., Hülde-sheim.....	1,800-2,400	Mens', women's, and youths' McKay sewn.

German shoe manufacturers—Continued.

DÜSSELDORF DISTRICT—Continued.

Names of firms.	Pairs per week.	Class of work.
OTHER PLACES—continued.		
Nordstern G. m. b. H., Hildesheim.	200- 300	Men's and women's Goodyear welt.
Von der Heide Gebr., Kamen.	500- 600	Men's, women's, and youths' McKay sewn.
C. Henter, Kamen.	1,200-1,800	Do.
Niederrheinische Schuhfabrik G. m. b. H., Kervenheim.	400- 600	Men's and women's McKay sewn.
Terhoeven Söhne, Kevelaer.	1,500-1,800	Men's, women's, and youths' McKay sewn.
C. H. Hünnekes, Kevelaer.	400- 600	Do.
Geschw. Bergmann, Kevelaer.	900-1,100	Do.
W. Krohn, Krefpe.	600- 700	Do.
F. Drenhaus, Lünen.	400- 500	Men's and youths' McKay sewn.
W. Conrad, Lövenich.	1,200-1,500	Do.
H. Vogels, M. Gladbach.	700- 900	Men's, women's, and youths' McKay sewn.
Vieten Wienand, M. Gladbach.	2,100-2,400	Men's and youths' McKay sewn.
Jacob Heck, M. Gladbach.	300	Men's and women's McKay sewn.
Decker & Co., Nachf., Mülfert.	600- 700	Men's, women's, and youths' McKay sewn.
H. Prenzier & Sohn, Osnabrück.	1,500-1,800	Do.
M. Auerbach, Paderborn.	700- 900	Men's and women's McKay sewn.
Zurwonne Gebr., Soest.	2,700-3,000	Men's and youths' heavy pegged.
Rheinische Sandalen Fabrik G. m. b. H., Süchteln.	1,000-1,200	Men's, youths', and girls' McKay sewn.
P. M. Tauwel, Straelen.	300	Football McKay sewn.
J. W. Dorn vor. C. Berthold, Unna.	1,800-2,000	McKay-sewn sandals.
C. Frese, Uetersen.	1,500-1,700	Men's and youths' McKay sewn.
F. W. Gliesecke, Peine.	400- 600	Men's, women's, and youths' McKay sewn.
C. Hundt, Peine.	200- 300	Do.
H. Kerkhoff & Söhne, Uedem.	200- 300	Men's, women's, and youths' Goodyear welt.
Fr. Winkins, Ratheln.	400- 500	Men's, women's, and youths' McKay sewn.
J. Vossen, Rath.	300- 400	Men's and youths' McKay sewn.
L. Stern & Co., Rheydt.	1,500-1,700	Men's and youths' McKay sewn and pegged (heavy).
Seuwen Gebr., Rheydt.	900-1,100	Men's and youths' McKay sewn.
B. Krüppel & Co., Rheydt.	600- 800	Men's, women's, youths', and children's McKay sewn.
Scheulen & Rees, Rheydt.	2,500-3,000	Men's and youths' McKay sewn.
C. Breidling & Sohn, Soltau.	1,500-1,800	Do.
Twenhöfel, Varel.	1,200-1,500	Do.
A. Flöring, Wermelskirchen.	1,800-2,100	Do.
Ischardt & Kattwinkel, Wermelskirchen.	600	Men's, women's, and youths' Goodyear welt.
A. Nippel, Wermelskirchen.	1,500-1,800	Men's, women's, and youths' McKay sewn.
R. & A. Pfeiffer, Wermelskirchen.	400- 500	Various heavy pegged.
P. Laermann, Wetten.	3,500-4,200	Men's, women's, and youths' McKay sewn.
J. Kisters, Wetten.	400- 500	Men's and women's Goodyear welt.
Schuster & Zimmer, Wickrath.	1,200-1,400	Men's and women's McKay sewn.
G. Stinshoff, Witten.	300- 400	Men's and women's Goodyear welt.
F. W. Böhmer, Xanten.	600- 700	Men's, women's, and youths' McKay sewn.
	200- 250	Men's, women's, and youths' Goodyear welt and McKay sewn.
	500- 600	Various pegged, heavy handwork.
	500- 600	
	1,200-1,500	Men's, women's, youths', and children's McKay sewn.
	1,000-1,200	Men's, women's, and youths' McKay sewn.
	600	Men's and women's Goodyear welt.
	1,800	Men's, women's, and youths' McKay sewn.

FRANKFORT ON THE MAIN DISTRICT.

BURGKUNDTADT.		
P. Pretzfelder.	1,000-1,300	Men's McKay sewn and pegged.
H. Pfls.	3,000	Men's and women's McKay sewn and pegged.
Pretzfelder & Rixinger.	3,000	Do.
Igauer & Co.	900-1,000	Men's, women's, youths', and children's McKay sewn and pegged.
J. Weiermann, A. G.	1,000	Men's and women's Goodyear welt.
	2,500	Men's and women's McKay sewn and pegged.
DETTWEILER.		
Levy Frères & Co.	900-1,000	Men's and women's McKay sewn and pegged.
A. Roth.	1,800-2,000	Men's and women's McKay sewn and pegged, heavy.
Schirmer-Haas.	150- 200	Do.
Schmitt-Huber.	500- 600	Do.
G. Vogel, G. m. b. H.	2,500-3,000	Do.
G. Zimmermann.	1,000-1,200	Do.

German shoe manufacturers—Continued.

FRANKFORT ON THE MAIN DISTRICT—Continued.

Names of firms.	Pairs per week.	Class of work.
FRANKFORT ON THE MAIN.		
Schuhfabrik Herz A. G.	6,000	Men's, women's, and children's Goodyear welt.
	900	Men's, women's, and children's McKay sewn.
	600- 800	Men's, women's, youths', and children's turns.
Goldschmidt & Poewenick...	20,000	Men's, women's, and children's felt shoes.
	3,000	McKay sewn slippers.
	500	Turned slippers (handwork).
R. & W. Nathan	1,500- 1,800	Women's, girls', youths', and children's turns.
	1,200	Women's, girls', youths', and children's McKay sewn.
J. & C. A. Schneider	1,300	Children's turns; some handwork.
OFFENBACH.		
H. Heroux	1,500- 1,800	Men's and women's Goodyear welt and McKay sewn.
E. Liebmann	3,000	All kinds Goodyear welt.
H. Liebmann	1,800- 2,000	Men's and women's Goodyear welt and McKay sewn.
Ochsenhirt & Behrens	12,000-15,000	Do.
Herrn. Peters	1,200	Men's and women's Goodyear welt.
	900	Men's and women's McKay sewn.
Union G. m. b. H.	1,800	Men's and women's Goodyear welt and McKay sewn.
E. Wallerstein	7,000	Men's, women's, and children's Goodyear welt.
	300	Women's turns.
OTHER PLACES.		
Aug. Gots, Alzey	3,000- 3,500	Men's pegged.
E. Hudelmaier Alzey	4,000- 4,500	Do.
Mans A. G., Bamberg	800- 900	Men's, women's, youths', and children's Goodyear welt.
	600	Men's, women's, youths', and children's McKay sewn.
Neuburger Gebr., Bamberg ..	4,500- 5,000	Men's, women's, youths', and children's McKay sewn, pegged, and veldtschoen.
	350	Men's McKay sewn.
W. Spahr, Beilstein	4,000	Felt slippers.
R. & L. Weyl, Benfeld	3,000- 3,500	McKay sewn slippers.
L. Weil & Co., Bischweiler ..	2,500	Do.
C. Bühler, Bischweiler	1,500	Men's, women's, youths', and children's pegged.
G. P. Groß, Bretten	4,000	McKay sewn and pegged slippers.
A. Salsberger & Sohn, Brunsal ..	1,500- 1,800	Men's, women's, youths', and children's heavy pegged.
Rumpf & Sohn, Butsbach	300- 400	Men's and women's McKay sewn and pegged.
H. Dreher, Butsbach	1,200- 1,500	Men's and women's heavy pegged.
J. Kronenbusch, Com a. S.	1,000	Pegged slippers.
Feister & Dehmer, Hainstadt ..	1,500- 1,800	Men's and women's turned slippers (handwork).
W. Wachsmuth, Hanau	1,500- 1,800	Men's and women's Goodyear welt and pegged; also sport-ing boots.
Herrn. Wils, Heidelberg	8,000-10,000	Men's and women's pegged slippers.
Schlierbach	4,000	Do.
Neff & Schelle, Heilbronn	3,000	Do.
Falk Siegel, Heilbronn	2,000	Do.
Fr. Weber, Heilbronn	3,000- 3,500	Men's and women's McKay sewn and pegged slippers.
Schwarzwälder & Wolf, Heil-bronn ..	3,000- 3,500	Do.
Comr. Schür, Herzogensaurach ..	6,000	Men's and women's felt shoes.
Heinr. Schür, Herzogensaurach ..	2,000	McKay sewn slippers and sandals.
Ver. Fränkische Schuhfabriken, Herzogensaurach ..	3,000	Pegged sandals.
	4,000	Men's and women's pegged slippers.
A. J. May, Kronach	3,000- 3,500	Men's, women's, youths', and children's McKay sewn and pegged.
Coblitz & Walzenbach, Kirchheimbolanden	600- 800	Men's and women's Goodyear welt.
Th. Meller & Co., Bockenheim ..	600- 800	Men's and women's McKay sewn.
Breunig & Collin, Oerrad	1,800- 2,000	Men's and women's Goodyear welt and McKay sewn.
Metzger & Süßspeck, Forth	1,500- 1,800	Men's and women's McKay sewn and pegged.
S. Schloss & Co., Fuerth	1,500- 1,800	Men's, women's, and youths' McKay sewn and pegged; also sandals.
	3,000	Women's McKay sewn.
J. Well, Fuerth	3,000	Felt slippers.
Ver. Fränkische Schuhfabriken, Fuerth ..	6,000	McKay sewn sandals.
	3,000	Men's, women's, and children's veldtschoen.
	1,200	Children's McKay sewn.
H. Munder, Künseisau	1,500- 1,800	Men's and women's McKay sewn and pegged.
Nilsen Gebr., Ladenburg	1,200- 1,400	All kinds McKay sewn and pegged.
J. Heinsheimer, Mannheim	6,000- 8,000	Men's and women's pegged slippers (prison work).
Eichbaum & Co., Mainz	1,200- 1,500	Men's and women's McKay sewn.
Emil Wels, Mainz	1,500- 1,800	Men's and women's Goodyear welt.
S. Wolf, Mainz	1,500- 1,800	Do.
	400	Men's and women's McKay sewn.
	500	Men's and women's turns.
L. Streits Söhne, Mannheim ..	2,000- 2,500	Wooden shoes.

German shoe manufacturers—Continued.

FRANKFORT ON THE MAIN DISTRICT—Continued.

Names of firms.	Pairs.	Class of work.
OTHER PLACES—continued.		
Legris Frères Nachf., Metz..	1,800- 2,000	All kinds McKay sewn and pegged.
A. Legris & Fils, Metz.....	1,200- 1,600	Do.
L. Manjean, Metz.....	3,000	Do.
Seifert & Kloeber, Nalla.....	400	Men's and women's Goodyear welt.
O. Tamm & Co., Nalla.....	6,000- 6,500	Men's and women's McKay sewn, pegged, and felt shoes.
A. Bieringer & Co., Nürnberg	1,500	Men's and women's heavy pegged.
L. Heilmann & Co., G. m. b. H., Nürnberg	1,800- 2,000	Men's and women's McKay sewn and pegged.
Ver. Fränkische Schuhfabriken, Nürnberg	2,000	Mens, women's, and children's Goodyear welt, McKay sewn, and pegged.
J. Einstein, Oehringen.....	50,000-60,000	Men's and women's Goodyear welt, and all kinds McKay sewn, turned, and pegged.
Müller & Heinz, Proseck.....	1,800	Men's and women's pegged slippers.
J. Ott, Proseck.....	1,500	Men's and women's McKay sewn and pegged.
Von Arnim, Rehau.....	250- 300	Men's and women's; cheap articles.
Wolf & Co., Sonthelm-Hellbronn.	900	Do.
E. Heilmann, Schweinfurt....	10,000	All kinds McKay sewn and pegged, including some sandals.
Silberstein & Neumann, Schweinfurt.	1,000	Men's and women's Goodyear welt.
George Roth, Schweinfurt....	2,000	Men's, women's, and children's McKay sewn and pegged; some sandals.
Ver. Leder & Schuhfabriken, Wosloch.	1,800- 2,000	Men's and women's Goodyear welt.
	1,200	Men's, women's, and children's Goodyear welt, McKay sewn, and pegged.
	2,000	Men's, women's, and children's McKay sewn and pegged.

DRESDEN DISTRICT.

DRESDEN.		
Paul Eberle.....	200	Men's and women's Goodyear welt.
	1,500	Men's and women's McKay sewn.
	500	Men's and women's pegged.
Carl Heysing.....	1,500	Men's and women's McKay sewn.
	1,200	Men's and women's turns (hand and home work).
E. Heilmann.....	2,000	Children's McKay sewn.
	1,200	Children's turns.
	1,200	Children's turns (handwork).
E. Hammer G. m. b. H.....	3,600	Men's and women's Goodyear welt.
	4,500	Men's and women's McKay sewn.
	1,200	Men's and women's turns.
	6,000	Men's and women's turns (handwork).
Paul Lösch.....	800	Men's and women's McKay sewn.
	400	Men's and women's pegged.
Van Leyen.....	1,200	Children's turns (handwork).
Müller & Sprung.....	1,500	Men's and women's Goodyear welt.
	1,200	Men's and women's McKay sewn.
	1,200	Men's and women's veldtschoen.
H. Pampel.....	100	Men's and women's Goodyear welt.
	900	Men's and women's McKay sewn.
	200	Men's and women's turns (handwork).
Nierth & Heibig.....	100	Men's and women's Goodyear welt.
	600	Men's and women's McKay sewn.
	200	Men's and women's turns (handwork).
L. & I. Salinger.....	600	Men's and women's McKay sewn.
Carl Silbermann.....	1,800	Men's and women's felt shoes.
C. Treibmann & Sohn.....	200	Men's and women's Goodyear welt.
	1,200	Men's and women's McKay sewn.
	300	Men's and women's pegged.
	300	Men's and women's turns.
EHRENFRIEDERSDORF.		
A. Atmanspacher.....	1,800	Men's and women's Goodyear welt.
	1,200	Men's and women's McKay sewn.
	200	Men's and women's pegged.
Carl Franke.....	500	Men's and women's Goodyear welt.
	1,200	Men's and women's McKay sewn.
	300	Men's and women's pegged.
Carl Heibig.....	500	Men's and women's McKay sewn.
	500	Men's and women's pegged.
A. Hillig.....	300	Men's and women's McKay sewn.
	300	Men's and women's pegged.
Billig & Fischer.....	250	Men's and women's McKay sewn.
	250	Men's and women's pegged.

German shoe manufacturers—Continued.

DRESDEN DISTRICT—Continued.

Names of firms.	Pairs per week.	Class of work.
ERBENFRIEDERSDORF—CON.		
Münch & Reuther.....	200	Men's and women's McKay sewn.
	200	Men's and women's pegged.
A. Rockstroh.....	200	Men's and women's McKay sewn.
	200	Men's and women's pegged.
GRÖTZSCH.		
Götze & Fischer.....	900	Men's and women's Goodyear welt.
	1,200	Men's and women's McKay sewn.
	200	Men's and women's turns.
O. & E. Kalischer.....	1,500	Men's and women's Goodyear welt.
	800	Men's and women's McKay sewn.
Domhardt & Co.....	1,200	Do.
R. Gutschhahn.....	1,000	Do.
	200	Men's and women's pegged.
A. Heine.....	100	Men's and women's Goodyear welt.
	900	Men's and women's McKay sewn.
	300	Men's and women's pegged.
ROESWEIN.		
L. Stadler.....	120	Men's and women's Goodyear welt.
	600	Men's and women's McKay sewn.
	300	Men's and women's pegged and turns.
	1,000	Men's and women's turns.
	1,000	Men's and women's felt shoes.
A. Heller.....	4,000	Children's McKay sewn.
	10,000	Children's turns.
Carl Fuchs.....	220	Men's and women's Goodyear welt.
	1,500	Men's and women's McKay sewn.
	300	Men's and women's pegged.
	1,000	Men's and women's turns and pegged.
Schulze & Ulbricht Nachf....	120	Men's and women's Goodyear welt.
	800	Men's and women's McKay sewn.
	300	Men's and women's pegged.
SEIFENHAINSDORF.		
A. Oppelt.....	400	Men's and women's McKay sewn.
	200	Men's and women's pegged.
	3,000	Men's and women's felt shoes.
R. Masslich.....	700	Men's and women's McKay sewn.
	500	Men's and women's pegged.
	2,000	Men's and women's felt shoes.
C. G. Michel.....	2,500	Do.
Paul Mehlich.....	2,000	Do.
WALDEHIM.		
Wernigk & Co.....	1,000	Men's and women's Goodyear welt.
Trüschel & Schubert.....	200	Men's and women's McKay sewn.
	500	Men's and women's pegged.
Schön & Schmidt.....	1,000	Men's and women's Goodyear welt.
	100	Men's and women's McKay sewn.
R. Gärditz.....	1,400	Do.
OTHER PLACES.		
Büttner & Co., Elterlein.....	400	Men's and women's turns (handwork).
Haug & Leonhardt, Eppendorf.	9,000	Men's and women's McKay sewn.
	12,000	Men's and women's pegged.
	1,200	Men's and women's veldtschoen.
F. Wetzel & Sohn, Freiberg...	600	Men's and women's McKay sewn.
	800	Men's and women's pegged.
	5,000	Men's and women's felt shoes.
Rau & Vogel, Gr. Hartau....	2,000	Do.
J. Fein & Söhne, Hartha.....	2,000	Do.
H. Müller, Hartha.....	1,500	Do.
Paul Otto, Hartha.....	1,200	Do.
Burckhardt & Sohn, Leipzig.	1,500	Men's and women's Goodyear welt.
	800	Men's and women's McKay sewn.
Zehl & Co., Leisnig.....	150	Men's and women's Goodyear welt.
	800	Men's and women's McKay sewn.
	500	Men's and women's pegged.
Nedon Gebr., Löbau.....	1,200	Men's and women's McKay sewn.
	10,000	Men's and women's felt shoes.
Auerswald & Sauerbrunn, Lösnitz.	400	Men's and women's Goodyear welt.
	900	Men's and women's McKay sewn.
	500	Men's and women's pegged.
Gerber & Müller, Lösnitz....	12,000	Children's McKay sewn.
	6,000	Children's pegged.
	18,000	Children's turns (handwork).

German shoe manufacturers—Continued.

DRESDEN DISTRICT—Concluded.

Names of firms.	Pairs per week.	Class of work.
OTHER PLACES—continued.		
Joh. Gessner, Lössnitz.....	1,000	Men's and women's turns (handwork).
Berkowitz, Heyl & Co., Lucka.....	1,000 800	Men's and women's Goodyear welt. Men's and women's McKay sewn.
Preuss & Möbius, Meissen....	1,000 900	Men's and women's Goodyear welt. Men's and women's McKay sewn.
Herm. Möbius, Meissen.....	1,200 1,200	Men's and women's Goodyear welt. Men's and women's McKay sewn.
Weichold & Sohn, Mittweida	1,800	Do.
Schurig & Prüfer, Mügeln....	300	Men's and women's turns.
Gocht & Co., Neugersdorf....	2,500 400	Men's and women's felt shoes. Men's and women's McKay sewn.
P. Herrlich, Oschatz.....	500	Men's and women's pegged.
A. Marthaus, Oschatz.....	2,000	Men's and women's felt shoes.
A. Kunze Nachf., Oschatz....	6,000	Do.
F. Dietsch, Pegau.....	2,000	Do.
	150	Men's and women's Goodyear welt.
	900	Men's and women's McKay sewn.
F. Fischer, Pegau.....	300	Men's and women's pegged.
	1,000	Men's and women's turns.
R. Nimschritz, Pegau.....	10,000	Men's and women's felt shoes.
	400	Men's and women's McKay sewn.
Herm. Löser, Rochlitz.....	500	Men's and women's pegged.
Herm. Thieme, Rochlitz.....	600	Men's and women's McKay sewn.
	150	Men's and women's Goodyear welt.
	600	Men's and women's McKay sewn.
	300	Men's and women's pegged.
Höfer & Hockemeyer, Siebenlehn.....	1,100	Men's and women's Goodyear welt
Krug & Co., Stollberg.....	800	Children's McKay sewn.
	1,200	Children's turns (handwork).
Moritz Schubert, Thum.....	300	Men's and women's McKay sewn.
	200	Men's and women's pegged.
A. Herrmann, Wolkenstein..	300	Men's and women's McKay sewn.
	300	Men's and women's pegged.
A. Trommler, Zwönitz.....	18,000	Children's McKay sewn.
	4,000	Children's pegged.
	15,000	Children's turns (handwork).

BERLIN DISTRICT.

BERLIN.		
Gg. Beck.....	800	Men's and women's turns.
J. Goldmann.....	1,500	Men's and women's turns; also felt shoes.
H. Hintze Nachf.....	1,500	Men's and women's turns.
	2,400	Men's and women's felt shoes.
J. Jacobius & Söhne Nachf...	3,600	Men's and women's McKay sewn.
	3,600	Men's and women's veldtschoen.
Max Klug.....	1,800	Men's and women's McKay sewn.
Müller & Schlitzweg.....	1,500	Men's and women's turns; also men's and women's McKay sewn and felt shoes.
E. Pinner Nachf.....	3,600	Men's and women's McKay sewn.
	5,000	Men's and women's felt shoes.
	8,000	Turned slippers and ball shoes.
S. Rosenberg & Röttschke....	4,000	Men's and women's McKay sewn.
	4,000	Men's and women's turns and felt shoes.
A. Schweiger.....	1,500	Men's and women's turns; also men's and women's McKay sewn.
Silberberg Gebr.....	800-900	Men's and women's turns.
OTHER PLACES.		
H. Jacobowski, Rixdorf-B...	6,000	Gymnastic McKay sewn.
	2,000	Men's and women's veldtschoen.
Reh & Prädcl, Britz-B.....	900	Do.
J. Brilles, Bromberg.....	700	Men's and women's Goodyear welt.
	900	Men's and women's McKay sewn.
	300	Gymnastic McKay sewn.
	300	Men's and women's veldtschoen.
V. Weynerowski & Sohn, Bromberg.....	2,400	Men's and women's McKay sewn.
	18,000	McKay-sewn slippers.
O. Sally & Co., Frankfort on the Oder.....	900	Men's and women's Goodyear welt.
	900	Men's and women's McKay sewn.
P. Schlesinger, Frankfort on the Oder.....	700	Men's and women's Goodyear welt.
	1,400	Men's and women's McKay sewn.

German shoe manufacturers—Concluded.

BERLIN DISTRICT—Concluded.

Names of firms.	Pairs per week.	Class of work.
OTHER PLACES—concluded.		
Senger & Stockwald, Furstenwalde.	1,200	Men's and women's turns.
B. Wiener, Hohensalsa.....	2,500-3,000	Men's and women's McKay sewn.
Haase & Russ, Nowawes.....	700	Men's and women's pegged.
	6,000	Men's and women's McKay sewn.
R. Sieburth Söhne, Posen....	600	Men's and women's Goodyear welt.
W. Zablocki, Posen.....	800	Men's and women's pegged.
H. Schliewe, Storkow.....	250	Men's and women's Goodyear welt.
P. Lainga, Strausberg.....	3,600	Men's and women's McKay sewn.
	360	Men's and women's Goodyear welt.
	360	Men's and women's McKay sewn.
M. Tack, Strausberg.....	1,500	Men's and women's Goodyear welt.
	1,500	Men's and women's McKay sewn.
Vater Gebr., Strausberg.....	600	Men's and women's Goodyear welt.
	1,000	Men's and women's McKay sewn.
W. Gotthelmer, Breslau.....	700	Men's and women's pegged.
Kaempffe & Latsch, Breslau..	1,200	Men's and women's McKay sewn.
M. Wohlaue, Breslau.....	3,000-3,600	Men's and women's Goodyear welt.
	300	Men's and women's McKay sewn.
Ertel & Scholz, Glatz.....	2,000	Men's and women's Goodyear welt.
Rosenstein & Prerauer, Landshut.	700-800	Do.
	3,000	Men's and women's McKay sewn.
M. Wielum, Liegnitz.....	1,500-1,800	Do.
G. Klemm, Oels i. Sch.....	12,000	Men's and women's McKay sewn and felt shoes.
E. Frankel's Nachf., Ratibor.	800-900	Men's and women's McKay sewn and Goodyear welt.



DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF MANUFACTURES
A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 51

COTTON GOODS IN RUSSIA

By

RALPH M. ODELL

Commercial Agent of the Department of Commerce and Labor

TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD



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LETTER OF TRANSMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
Washington, May 15, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1912, approved March 4, 1911, a report by Commercial Agent Ralph M. Odell, of this department, containing the result of his investigations of the cotton-goods trade in Russia.

Respectfully,

BENJ. S. CABLE,
Acting Secretary.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, March 16, 1912.

SIR: I have the honor to submit herewith a report by Commercial Agent Ralph M. Odell dealing with the various phases of the cotton industry and trade of Russia, which ranks fourth among the countries of the world both in cotton manufacturing and in the production of raw cotton. Because of the high customs duties imposed by that country on imports of cotton manufactures, it is not a good field for the exploitation of American products. However, Russia is developing an export trade in cotton goods, notably in Persia and China, and the report by Mr. Odell should prove of interest and value to American manufacturers engaged in foreign trade.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

To Hon. CHARLES NAGEL,
Secretary of Commerce and Labor.

COTTON GOODS IN RUSSIA.

COTTON MANUFACTURING.

CHARACTER AND DEVELOPMENT OF THE INDUSTRY.

Russia ranks fourth in importance among the cotton-manufacturing countries of the world, being exceeded in number of spindles by Great Britain, the United States, and Germany. The cotton industry is a very old one in Russia, hand-loom weaving and printing having been carried on in 1700; it was not until the middle of the nineteenth century, however, that the organization of the industry on modern lines was begun.

In the eighteenth century cotton goods of Asiatic production were brought to the annual fair at Nizhni Novgorod, at that time the chief commercial center in Russia. Later Turkey red dye was brought up the River Volga, and the art of dyeing and printing fabrics was acquired. The latter branch of the industry was largely developed in the early part of the nineteenth century by French prisoners left in Russia after the war of 1812, many of whom were Alsatians and were very skillful in the art. That this influence has persisted is indicated by the fact that the largest printing mill in Russia to-day is managed by Alsatians.

With the development of the art of printing there was an increased demand for cotton cloths, to supply which goods were brought in from Asia and later from Germany and England. Cottage weaving also became more important and some peasants operated 15 to 20 hand looms, yarns for which were bought from abroad on long terms of credit.

In 1840 the prohibition of the export of cotton machinery from England to Russia was removed, and that date marks the beginning of the modern Russian industry. The pioneer was Ludwig Knoop, a German, who came to Moscow in 1839 as the representative of English yarn merchants. His personality soon won him many friends, and he was requested by some business men to erect a cotton mill and equip it with English machinery. He undertook the task, and through his connections in England secured the machinery on favorable terms. Soon afterwards, through the aid of Knoop, many of the yarn dealers also became spinners. The firm of Platt Bros., English manufacturers of cotton-mill machinery, made him their exclusive agent in Russia. As he knew his customers well, he granted them liberal credit, discounted their drafts, brought over English managers and clerks, and later began to import cotton and supply the mills with raw material. In payment for machinery, supplies, cotton, etc., Knoop frequently accepted shares in the mills, and to-day his successors in the firm of L. Knoop have an interest in nearly all the important mills and are dominant factors in the industry.

Better banking facilities in Russia have made it possible for many of the mills to become more independent, but the fact that they can not use machinery and stock in process, but only land and buildings, as security for loans, has increased the importance of private money lenders.

FACTORS IN THE DEVELOPMENT OF THE INDUSTRY.

The policy adopted by Knoop, that of engaging Englishmen as managers and using English methods in the mills, is a striking feature of the industry to-day. In fact, with few exceptions, the most successful mills are those that have been under English management. In some instances attempts have been made to break away from this influence, but with Russian management the plant has often deteriorated and profits have decreased, and in the end English managers have been called in to conduct the business. Many of the mills I visited were like English mills transferred to Russian soil, and undoubtedly this fact is responsible, in large measure, for the prosperity the industry has enjoyed. Many of the managers have been trained in Lancashire mills, and they are efficient, progressive, and alert to the most modern methods of management. In the power plant they direct their efforts to securing the most efficient method of driving at a minimum cost; in buying raw material they select and mix the types of cotton best adapted to their needs; in the spinning and weave rooms they concentrate their efforts to obtain a maximum production at the lowest possible cost. The spirit of progressiveness, which is absent in some lines of Russian endeavor, is nowhere lacking in the cotton industry.

CUSTOMS DUTIES.

Another factor in the development of the industry is the high tariff, which practically eliminates foreign competition. The Russian tariff on manufactured goods is one of the highest in the world. The duties on yarn and various fabrics are shown in the following table:

Articles.	Duty per pound.
Yarn:	
Single—	
Below No. 38—	<i>Cents.</i>
Unbleached.....	11.60
Bleached, dyed, or mercerized.....	15.36
Dyed Turkey red.....	15.97
No. 38 to No. 60, inclusive—	
Unbleached.....	15.09
Bleached, dyed, or mercerized.....	19.25
No. 60 to No. 80, inclusive—	
Unbleached.....	22.82
Bleached, dyed, or mercerized.....	26.38
Above No. 80—	
Unbleached.....	31.37
Bleached, dyed, or mercerized.....	34.94
Twisted—	
On wooden spools, prepared from yarn of—	
Below No. 60.....	19.25
No. 60 to No. 80, inclusive.....	25.67
Above No. 80.....	34.94
All other kinds, prepared from yarn of—	
Below No. 60.....	23.53
No. 60 to No. 80, inclusive.....	32.09
Above No. 80.....	45.49
Fabrics:	
Unbleached or bleached—	
Biaz and mitkal (coarse calico) of up to 5.4 square yards per pound.....	32.80
Biaz and mitkal of from 5.4 to 8 square yards per pound, and all other fabrics of up to 8 square yards per pound.....	51.34
All fabrics over 8 square yards per pound.....	122.65
Dyed, printed, or mercerized—	
Biaz, mitkal, and chintz of up to 5.4 square yards per pound.....	55.90
Biaz, mitkal, and chintz of from 5.4 to 8 square yards per pound, and all other fabrics of up to 8 square yards per pound.....	76.96
All other fabrics over 8 square yards per pound.....	148.33
Cotton velvet, plush, and plush ribbon.....	62.70
Knit goods, all kinds.....	42.78

This tariff, which is equivalent to 40 to 50 per cent ad valorem, has enabled the manufacturers to operate their mills on a profitable basis for a number of years and accounts for the steady growth of the industry. The average increase in the number of spindles is about 250,000 yearly.

OTHER FACTORS IN INDUSTRY'S GROWTH.

An abundance of cheap labor, a supply of home-grown cotton that furnishes the mills with 50 per cent of the required raw material, and a large and increasing domestic demand for cotton goods are other factors that have contributed to the growth of the industry. Russia comprises a vast territory containing one-seventh of the total land surface of the globe, and the use of cotton goods among its population of more than 160,000,000 is constantly increasing. With the improved condition of the Russian peasants, the use of underwear, formerly almost unknown, is becoming more general, and this has an important bearing on the industry, for on account of their cheapness cotton goods are more widely worn than woolen fabrics.

In 1890 the per capita consumption of cotton cloth in Russia was only 2.31 pounds, while in 1910 it had increased to 4.56 pounds. The great railroad development during the past two decades has widened the markets and increased the demand for manufactured articles by bringing the people closer together. Russia is a country of great distances and before the development of railroads travel was difficult and expensive; villages far removed from industrial centers were practically isolated. By means of the railroad, however, the country merchant was enabled to travel to distant market centers; villagers made trips to the cities and came back with tales of the life there and with new styles of dress. In this way the immense market in Russia was first created and it has grown rapidly with the years.

STATISTICAL RECORD OF PROGRESS.

The following table, compiled from figures furnished by the Department of Commerce and Industry in St. Petersburg, shows the growth of the Russian cotton industry from 1850 to the present time:

Years.	Spindles.	Looms.	Cotton consumed.		
			Russian.	Foreign.	Total.
			Pounds.	Pounds.	Pounds.
1850.....	1,100,000	(1)	(1)	(1)	72,200,000
1860.....	1,600,000	(1)	(1)	(1)	90,250,000
1870.....	2,000,000	(1)	(1)	(1)	144,000,000
1880.....	2,300,000	(1)	(1)	(1)	180,500,000
1880.....	3,457,716	87,190	71,710,412	215,900,201	287,610,613
1885.....	4,576,930	108,174	127,014,240	302,473,308	429,487,548
1900.....	6,645,569	151,306	220,601,793	357,234,156	577,835,949
1905.....	7,350,683	178,506	246,585,310	355,659,438	602,244,748
1906.....	7,443,854	182,878	311,871,989	340,833,240	652,705,229
1907.....	7,562,478	188,021	365,784,766	337,950,800	703,735,566
1908.....	7,807,143	194,402	295,714,955	457,822,246	753,537,201
1909.....	8,064,707	200,510	388,613,395	379,367,175	767,980,570
1910.....	8,306,372	213,179	405,754,433	391,550,455	797,304,888
1911.....	8,448,818	220,000	(1)	(1)	(1)

¹ Statistics not available.

The foregoing table not only reveals the remarkable progress made by the Russian industry but also shows that Russia has obtained an increasing supply of raw cotton within its own borders. The foreign cotton consumed in 1890 formed 75.1 per cent of the whole, while in 1910 only 49.1 per cent of the raw material was purchased abroad. Finland, which has 222,846 spindles, is not included in the foregoing figures.

COTTON-MANUFACTURING DISTRICTS.

There are three well-defined centers of cotton manufacturing in Russia: (1) The central, or Moscow, district; the Baltic, or St. Petersburg, district, and (3) the western, or Polish, district. More than 99 per cent of the spindles are in these three districts.

The following table shows the number of spindles, looms, and operatives, the amount of cotton consumed, and the production of yarn and cloth in 1910 in the several districts and in the Governments (Provinces) of each district:

Districts and Govern- ments.	Spindles.	Looms.	Opera- tives.	Cotton consumed.		Production.	
				Russian.	Foreign.	Yarn.	Cloth.
				<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Central district:							
Moscow.....	1,910,044	48,792	95,751	122,397,447	70,822,280	174,339,174	132,921,536
Vladimir.....	1,470,952	35,545	119,603	89,575,561	57,724,153	132,048,854	157,572,935
Kostroma.....	672,318	30,644	53,756	47,786,472	24,283,134	63,644,067	80,267,050
Tver.....	403,988	10,144	19,123	22,954,510	17,745,930	36,709,188	32,320,351
Yaroslavl.....	375,224	1,848	9,860	33,456,660	10,472,121	39,082,041	5,389,094
Ryazan.....	202,676	3,750	9,890	14,404,622	6,374,718	19,063,110	11,084,000
Smolensk.....	136,785	1,637	5,253	11,946,888	1,191,825	11,497,200	6,263,921
Total.....	5,171,987	162,360	313,236	339,522,160	188,614,161	476,384,264	455,119,487
Baltic district:							
St. Petersburg.....	1,185,313	10,809	20,409	22,136,881	45,219,907	60,609,156	30,110,757
Estonia.....	552,342	5,294	11,139	12,298,479	30,709,151	39,175,142	15,508,058
Livonia.....	55,956	491	2,293	1,429,199	7,319,347	7,615,259	2,054,415
Total.....	1,793,611	16,594	33,841	35,861,559	83,248,405	107,399,557	47,670,230
Western district:							
Plotrkow.....	1,193,421	30,823	46,923	27,420,188	110,326,834	135,515,212	104,902,846
Warsaw.....	62,572	490	1,329	4,032,478	3,851,364	921,633	921,633
Kalisz.....	19,090	885	1,367	831,022	2,052,249	2,354,659	2,653,711
Total.....	1,275,083	32,188	49,619	28,695,998	116,411,561	141,721,235	108,468,190
All other districts.....	65,691	2,037	3,223	1,674,716	3,276,328	4,302,687	4,318,354
Grand total.....	8,306,372	213,179	399,912	405,754,433	391,550,455	729,807,743	615,576,261

ADVANTAGES ENJOYED BY THE SEVERAL DISTRICTS.

As will be seen from the preceding table, the central district is first in importance. Moscow was formerly the political capital of Russia and has maintained its importance as the Empire's chief railroad and industrial center. It is advantageously located geographically, being a meeting place between the east and the west. Good railroad facilities, easy transportation on the River Volga for the naphtha brought up from the great oil-producing center of Baku, a good supply of wood and peat for fuel when oil is not used, and an abundance of cheap labor are factors that have made the district around Moscow the chief center of the cotton industry. The emancipation of the serfs in 1861, which greatly stimulated industrial progress in all lines, left a large

number of peasants in this region without land, and they were the first to turn to industrial pursuits as a means of earning a livelihood.

The Baltic district has an advantage in being on the sea, enabling American cotton and English machinery to be imported direct, and a further advantage in that the mill workers there are more industrious and efficient than the operatives in the central district.

The industry in Poland has made great progress, owing partly to the high efficiency of the labor and partly to the district's proximity to western Europe, through which machinery, cotton, and fuel can be transported to the mills at a lower cost than is possible in manufacturing centers to the north and east. German influence is also very strong in Poland, and many of the mills there are branches of German firms. This alliance has obtained for them the credit advantages and banking facilities enjoyed by German manufacturers, and a large share of the business is conducted through German banks.

In Poland, as in St. Petersburg, however, the labor, while more efficient, costs about 10 per cent more than in the central district, and although the mills from their geographic position have the advantages already mentioned, they are not so well situated as those of Moscow and the surrounding district as regards marketing their output.

SPINDLAGE AND COTTON CONSUMPTION.

In general, the yarn spun and cloth woven in Poland are coarse; the product of the Baltic district is fine; while the mills of the central district manufacture a wide range of yarn and cloth. The following table shows the increase in the number of spindles in the more important Governments from 1890 to 1910, the consumption of cotton per spindle, and the average number of yarn spun in each Government (Province) in 1910:

Governments.	Number of spindles.			Consumption of cotton per spindle.	Average number of yarn.
	1890	1900	1910		
				<i>Pounds.</i>	
Moscow.....	875,568	1,514,591	1,910,044	101.1	28.80
Vladimir.....	565,271	1,213,572	1,470,952	91.3	31.24
Piotrkow (Poland).....	217,422	972,809	1,193,421	115.4	19.02
St. Petersburg.....	827,912	993,661	1,185,313	56.8	32.65
Kostroma.....	23,800	345,906	672,318	107.1	29.82
Esthonia.....	388,812	467,068	552,342	77.8	34.97
Tver.....	221,752	360,806	403,988	107.4	25.97
Yaroslavl.....	250,299	361,626	375,224	116.7	28.56

¹ If foreign waste consumed is included, this figure would be 129.7.

MILL CONSTRUCTION, EQUIPMENT, AND OPERATION.

The cotton industry in Russia is modeled after that of the United States, rather than that of England. Each firm generally carries on all the stages of manufacture and produces the finished cloth to be sold to the dealers or to the printers for converting purposes. Some of the larger mills have their own dyeing and print works. There are few mills without weaving departments, but some firms operate looms only, buying their yarn from the spinners.

Mills in Russia, almost without exception, are large. According to statistics of the Department of Commerce and Industry, the average

number of spindles per mill in 1890, 1900, and 1910 was 52,380, 56,800, and 52,241, respectively. The average number of spindles per mill is 77,981 in the Baltic district, 66,300 in the central district, and 23,611 in Poland. This average is considerably higher than that obtaining in the United States. Mills of 5,000, 10,000, and 15,000 spindles, which are not uncommon in the United States, particularly in the South, are seldom seen in Russia. A list of the spinning mills recently compiled by the Russian Cotton Manufacturers' Association shows that 1 mill has more than 400,000 spindles, 3 have more than 200,000, 10 have more than 150,000, and 26 have more than 100,000, while only about 25 have less than 25,000 spindles each.

One reason for such large establishments is that many of them are the outgrowth of smaller plants, founded many years ago, the profits from which have been used to increase the capacity of the mills. Another is the fact that a large amount of capital is required to build, equip, and operate a cotton mill in Russia and the fixed charges are so heavy that small mills are unprofitable.

Not only is the cost of machinery and supplies high, but the requirements for a complete cotton mill are greater than in other countries. There is no laboring class in Russia, as the term is understood in the United States, and many of the operatives are peasants who work in factories during the winter and return to their homes in summer to cultivate their small farms. It has thus been necessary for the cotton manufacturers to build villages around their mills; churches, schools, and hospitals are erected, often at considerable expense, and so-called "barracks," or tenements, are built in which to house the employees. At one mill I saw a new hospital being built at a cost of \$250,000; at another a new park and field for sports was being laid out for the benefit of the workpeople. All of these activities, as will later be pointed out more in detail, have undoubtedly made the wages of the operatives lower, but the fact remains that all these undertakings require an outlay of considerable capital, and as a mill can not hope to compete successfully without such an equipment the building of large plants has been encouraged.

The president of the Cotton Manufacturers' Association stated that out of every 100 rubles spent in building and equipping a cotton mill 40 to 50 rubles is devoted to activities outside the mill proper. Moreover, considerably more working capital is required in Russia than in the United States. Cotton is bought in large quantities and stored, and it is not unusual for a mill to have six or eight months' supply of raw material on hand. In marketing goods long terms of credit are the rule, 6 and sometimes 12 months being given.

LOCATION OF MILLS—OWNERSHIP.

Although many of the Russian cotton mills are located in and around the cities of Moscow, St. Petersburg, and Lodz, the mill town as it exists in the United States is practically unknown. Some of the largest mills are in isolated places away from the railway, and to reach one of them I had to drive 15 miles after leaving the train. In this respect the cotton industry of Russia resembles somewhat that of Spain, where the "colonia" is the unit of cotton-factory life. One reason for this is that railroad development has been slow and many

parts of the Empire are still without modern transportation facilities. Secondly, many of the mills are the outgrowth of smaller enterprises established years ago in places where labor was cheap or fuel plentiful, and as the mill increased in size it was never considered practicable to change the location.

The result is that cotton, supplies, cloth, and sometimes fuel must be carted in wagons for distances of 5 to 20 miles. With bad roads and the severe Russian winters it would seem that mills located at points distant from the railroad would be at a great disadvantage. As a matter of fact it is maintained that on account of the low cost of labor and high freight rates drayage is cheaper than railroad transportation. One mill near Moscow has only recently begun to use the railroad, it being a question whether this is more economical than the means formerly employed.

In the central district, particularly in the Government of Vladimir, proximity to large forests or deposits of peat has also been a determining factor in the location of mills without regard to transportation facilities. In some cases the cotton mill owns vast peat bogs, from which a supply of fuel for power is obtained. While the use of peat is far less economical than coal or oil, the latter two classes of fuel had not been introduced at the time many of the mills were established, and the plants were located at points where wood or peat could be easily obtained.

Part of the Russian cotton mills are privately owned, while others are organized on the joint-stock company plan with a comparatively small number of shareholders. Frequently the stock is owned or controlled by one family which has inherited it from the founders. Consequently there are few exchanges of shares and the stocks are not quoted on the market. According to the president of the Cotton Manufacturers' Association the total capital invested in spinning mills alone is 350,000,000 rubles (\$180,250,000). Most of the stock is in Russian hands, although English and German capital is also invested.

FACTORY BUILDINGS—INSURANCE—COST OF CONSTRUCTION.

The usual type of mill construction is brick, although new factories are being built of reenforced concrete. The mills are usually three to five stories high, although the modern tendency to build single-story weave sheds is noted among mills constructed in recent years. Floors are usually of cement and supports of iron or steel. Automatic sprinklers have been installed in many of the mills, over 1,000,000 now being in use. Humidifiers are also in general use, the vortex system being the most common. The mills are well lighted, heated, and ventilated, and the operatives work under as pleasant and healthy conditions as in England or the United States. While the buildings are perhaps not so roomy and spacious as Italian mills, the machinery is not crowded and is conveniently and economically arranged.

The mills are insured in a mutual fire insurance association which was organized in 1902. The average rates are 2.93 rubles per 1,000 on mills equipped with sprinklers and 6.80 rubles per 1,000 on mills not so equipped. The corresponding rates are 1.28 and 5.54 in England and 2.1 and 4.2 in Germany.

Taxes are rather high, but provision is made by the law for counting off 10 per cent of the value of the machinery each year before taxes are levied, with the result that many old companies are taxed on their land and buildings only, on which the deduction allowed is 5 per cent annually.

The cost of building a mill in Russia is considerably higher than in England, but about the same as in the United States, if we consider the mill proper. However, the number of other buildings that the manufacturer is practically compelled to erect makes the total much higher than in the United States. The cost varies with the location of the mill and with the kind of yarn or cloth manufactured, but if a spinning mill to make 30s to 40s single yarn is assumed the average cost is 25 rubles (\$12.875) per spindle. This includes the building, steam plant, machinery, humidifiers, and automatic sprinklers. The cost is 40 rubles (\$20.60) per spindle if there are included warehouses, tenements, schools, churches, hospitals, and other structures necessary for all mills. The cost of the building and machinery for an ordinary weave shed is 400 to 500 rubles (\$206 to \$257) per loom, depending, of course, on the kinds of goods to be woven, the amount of preparatory machinery, such as twistors, warpers, and slashers, and the amount of finishing machinery installed.

PRICES OF ENGLISH MACHINERY.

The prices of cotton-mill machinery are lower than they have been in many years, owing to the general depression in the cotton industry and the cessation of mill building in England. Following are the prices quoted for English cotton-mill machinery f. o. b. Moscow.

Machines.	Price.	Machines.	Price.
Crighton opener.....	\$566.00	Wet spinning frame, 6 by 2½ inches, 472 spindles.....	\$1,468.00
Opener with automatic feeder.....	2,264.00	Per spindle.....	2.11
Scutcher, intermediate or finisher.....	1,090.00	Mule spinning frame, 1½-inch space, 1,020 spindles.....	2,160.00
Revolving flat-top card:		Per spindle.....	2.11
40-inch.....	643.00	Twister frame, 232 spindles.....	865.00
45-inch.....	746.00	Per spindle.....	2.73
Sliver lap machine.....	772.00	Winder or spooler, 200 spindles.....	855.00
Ribbon lap machine.....	824.00	Beam warper:	
Comber.....	1,957.00	45-inch.....	286.00
Drawing frame, price per delivery.....	77.00	62-inch.....	334.75
Slubber, 11 by 5½ inches, 100 spindles.....	1,286.00	Slasher, 7 and 5 foot cylinders, 53 inches wide.....	2,160.00
Per spindle.....	12.86	Plain two-harness loom:	
Intermediate, 10 by 4½ inches, 156 spindles.....	1,544.00	English.....	122.00
Per spindle.....	9.90	Russian.....	95.00
Fine roving frame, 7 by 3½ inches, 200 spindles.....	1,432.00	Northrop loom, 40-inch reed space, for plain weave.....	283.00
Per spindle.....	7.16	Electric motor, 100 horsepower, a. c., 3-phase, complete.....	1,080.00
Warp spinning frame, 5 to 6 inch lift, 2½-inch gauge, 472 spindles.....	1,519.00		
Per spindle.....	3.21		

These prices were furnished by the manager of the oldest and most important cotton-mill machinery firm in Russia; they cover one of the leading makes of English machinery and are representative because practically all the mills are equipped with this make. The quotations include duty and transportation from the works in England to Moscow. Erection is at the expense of the mills.

CUSTOMS DUTIES ON MACHINERY.

The tariff on cotton-mill machinery amounts to about 45 per cent ad valorem at present prices. Duties are specific and are levied on the gross weight, which often makes the duty higher on cheaper machines than on more expensive ones. The tariff on cotton-mill machinery and supplies is shown in the following table:

Articles.	Rubles per pood.	Dollars per 100 pounds.
Spinning and weaving machinery.....	2.10	2.99
Machinery parts.....	4.20	5.99
Steam boilers.....	2.10	2.99
Steam and gas engines.....	3.20	4.56
Dynamo-electric machinery.....	8.50	12.12
Leather belting:		
Sewn.....	12.00	17.11
Unsewn.....	10.00	14.26
Loom strapping and roller skins.....	9.00	12.84
Paper bobbins and spools.....	6.00	8.56
Wooden bobbins, spools, and shuttles.....	3.00	4.28

Carding and spinning machinery is almost exclusively English, but some weaving, finishing, and power machinery comes from Germany and Switzerland. In more recent years looms have been made in Russia. Some of the largest mills manufacture their own looms in the well-equipped foundries and machine shops with which every up-to-date mill is provided.

SOURCE AND COST OF SUPPLIES.

The isolated location of many mills and their long distance from England have compelled them to furnish their own machinery supplies, gears, and spare parts, and nearly every mill I visited was also equipped with machinery for making harness and reeds. Other supplies, such as bobbins, spools, and belting, are usually handled by the machinery firms. Bobbins and belting are being made in Russia, but the home products are inferior in quality to those imported from England, and the manufacturers seem to prefer the latter, even at a considerably higher price. Some idea of the cost of bobbins, spools, and shuttles may be obtained from the following table, which gives prices per 100 f. o. b. Moscow, for both the English and the Russian product:

Articles.	English.	Russian.	Articles.	English.	Russian.
Roving bobbins, metal shields:			Wet pirns, 6-inch:		
10-inch.....	\$7.08	\$4.65	Painted tip and var-		
8-inch.....	5.18	3.56	nished—		
7-inch.....	4.29	2.23	With steel shield.....	\$1.25	\$0.83
6-inch.....	3.86	2.91	With brass shield.....	1.30	.95
Skewers:			Enameled black—		
10-inch.....	2.95	1.13	Without shield.....	1.68	1.06
7-inch.....	2.06	1.00	With brass shield.....	1.73	1.13
Warp spinning bobbins, 6-			Spools, varnished, painted		
inch:			ends, and with endless steel		
Painted tip and var-			tires:		
nished—			Size 5 by 34 inches.....	8.75	6.18
With steel shield.....	1.95	1.13	Size 5 by 4 inches.....	9.21	6.75
With brass shield.....	2.00	1.28	Shuttles, 12½ inches long:		
Enameled black, without			Cornel wood.....	29.02	20.08
shield.....	2.50	1.34	Persimmon.....	26.70	19.05

PRICES OF ENGLISH BELTING—AMERICAN TRADE.

Prices for different widths and thicknesses of English belting are given in the following table, the quotations being per foot f. o b. Moscow:

Widths.	No. 1.	No. 2.	No. 3.
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
Two inches.....	17.65	22.6	32.6
Two and one-half inches.....	24.2	30.8	40.6
Three inches.....	29.3	37.0	48.7
Three and one-half inches.....	33.9	43.2	56.9
Four inches.....	39.0	49.5	65.1

Efforts have been made to introduce American textile machinery, but they have not been very successful, owing to its high original cost, the high freight rates, the impossibility of making quick deliveries, and the preference of mill managers for English machinery. Pumps, sewing machines, and certain classes of dyeing and finishing machinery, such as driers and steamers, have been imported from the United States. Interest is also manifested in certain American labor-saving machinery, particularly warp tying-in machines. Cheapness of labor, however, has operated against the introduction of Northrop looms, and only about 1,000 of them are in use in Russia. An order has recently been placed for two American warp tying-in machines. The fact that the bulk of the cloth manufactured in Russia is plain gray goods creates an ideal situation for the adoption of these machines, provided they prove economical. American manufacturers of bobbins and spools might also secure trade in Russia, but great care should be exercised in producing goods according to sample.

MULE AND RING SPINNING.

Formerly the bulk of the yarn manufactured in Russian cotton mills was spun on mules, but in recent years ring spinning has been rapidly replacing mules because of the saving in cost of production. In 1890, for instance, 77.4 per cent of the spindles were mules, while in 1910 they constituted only 45.1 per cent of the total. In general, all the warp and about one-half the weft yarn is spun on ring frames, mules being used only for weft, for very high numbers, for yarns made from waste, and for special soft-twist yarns. Ring spinning frames usually have from 400 to 450 and even as many as 472 spindles, while mules have from 800 to 1,200.

The speed of both spinning and weaving machinery is high. Looms on ordinary print cloth 28 inches wide run at 210 to 225 picks per minute, and the average production is about 80 per cent of the theoretical. It is very difficult to ascertain production figures for spinning mills, as the percentage varies considerably in different factories and the wide range of yarns spun makes it difficult to secure accurate data. From information obtained in a number of mills the average production may be stated as approximately 77 per cent, although it is as low as 70 per cent in some of the mills and as high as 80 per cent in others.

USE OF HAND LOOMS—THE KUSTARI.

The use of hand looms in Russia, while considerably less than in former years, is still very extensive. The looms are scattered among the peasants throughout the country and the total number is unknown. Some idea of their importance is shown by the fact that the mill production of cloth in 1910 was 114,231,482 pounds, or 15 per cent, less than the production of yarn. As Russia's exports of yarn are considerably less than the imports, a large part of the yarn not woven on power looms, with the exception of that used for sewing thread, is ultimately sold to the peasants and utilized by them on hand looms.

Hand weaving is done by the "kustari" (household manufacturers), who occupy an important place in Russian life, in the making of not only textiles but many other lines, such as wooden articles and utensils, furniture, baskets, metal and clay products, hardware, tools, leather goods, shoes, jewelry, toys, as well as lace, embroideries, and carpets. All of these products are turned out in their homes by the peasants, who have attained great skill.

For the Russian peasant, agriculture is the principal occupation. Formerly his family constituted an economic unit; food, garments, utensils, etc., were derived solely from work of the household. The new conditions following the emancipation of the serfs in 1861, the growth of population, the exhaustion of the soil which forced the peasant to look for new sources of income, the increase of taxes and the need for money resulting therefrom, and the development of ways of communication prompted the peasant to begin the production of articles for exchange and sale, first to neighbors and then to consumers farther away. Yet the industry, as a whole, is for the peasant agriculturist but a subsidiary occupation followed during the long winter months, when he can not work in the field. Herein lies the secret of the maintenance of the industry in spite of the competition of machine-made articles. The peasant is satisfied with small earnings, inasmuch as they are for him only an extra source of income in times when he is not engaged in his main occupation.

ASSISTANCE GIVEN TO KUSTARI.

In the past few years, however, there has been a tendency to bring the peasant workers together. Firms build special cottages for the kustari, employ them during the whole year, and market the products in trade centers, the quality of the handmade articles securing for them a good sale. The Central Government has assisted the industry by establishing schools for teaching new processes, by publishing for the use of the kustari popular pamphlets and collections of designs, by organizing museums to advertise the products of the peasants, and by selling them raw materials on special terms.

The zemstvos, or local governing bodies, have also appropriated money for the encouragement of the industry; they have developed the technical side of the work, have assisted the kustari in buying raw materials at low prices and on liberal terms of credit, and have established stores for the sale of the articles produced.

The weaving of cotton goods by hand is confined chiefly to coarse goods such as are worn by the peasants and which are sometimes

made of cotton and sometimes of a mixture of cotton and wool, and to carpets. The chief centers are in the Governments of Moscow, Ryazan, Vladimir, and Kostroma. Yarn is usually purchased from a dealer, who sometimes employs the peasant to work for him at a daily wage of about 50 kopecks (\$0.2575). The weaving of carpets is carried on in the Governments of Poltava, Saratof, Bessarabia, and Kursk, in the south of Russia, and Tobolsk in Siberia.

KINDS AND COSTS OF POWER.

Steam power is used by most of the cotton mills in Russia. A few mills in the Baltic section are driven by the waters of the rivers along which they are built. In some cases steam is used to generate electric power, but direct drive from steam engines is very general, ropes being employed for driving main lines of shafting.

Most of the engines are supplied by domestic manufacturers, and the Diesel oil engine, made in Russia, is very popular. Oil engines are in general use, owing to the fact that gasoline, benzene, naphtha, and other oils are cheap and plentiful. The fields in the Baku district supply large quantities (about 8,000,000 tons annually) and the River Volga affords an easy means of transportation to the cotton mills in the central district.

In the Governments of Kharkof and Vladimir there are large deposits of peat, which forms about one-third of the fuel consumed in the latter district. Coal, too, is obtained in Russia and new mines are being opened up in many sections. The most important coal-producing center is the Donetz Basin, in southeastern European Russia. The annual yield from this section is 2,500,000 to 3,000,000 tons. As has been stated, many of the mills own forests and peat bogs from which they secure a supply of fuel at the actual cost of gathering and conveying it to the mill. Whether naphtha or coal is used depends on the prevailing price, as many of the steam plants are equipped to burn either coal or oil. When the price of coal is lower than that of oil, as at present, the former is more extensively used. Russian coal is now being sold in Moscow at 21 to 24 kopecks per pood (\$6.75 to \$7.60 per long ton) while naphtha is about 46 kopecks per pood (\$1.75 per barrel of 42 gallons). Wood for fuel is quoted at 25 rubles per cubic fathom (\$4.80 per cord), while peat is sold at 8 to 10 kopecks per pood (\$2.55 to \$3.20 per long ton).

The cost of steam power developed by an ordinary engine ranges from 80 to 100 rubles (\$41.20 to \$51.50) per horsepower per year, while the cost of power developed by a Diesel engine is as low as 50 rubles (\$25.75). It should be noted, however, that these figures are based on an actual operating time of 4,500 hours per year, and are to be compared with a corresponding cost of \$18 to \$25 in the United States for a year of approximately 3,000 hours.

SOURCES AND COST OF RAW MATERIAL.

The Russian industry enjoys the advantage of a large range of cottons from which to make a selection. While American mills are practically confined to home growths and Egyptian, the Russian spinner has American, Russian, Indian, Egyptian, and Persian varieties from which he may choose the class best suited to his pur-

pose. Cotton is selected with expert care and often different varieties of approximately the same length of staple are mixed when an advantage in cost can be gained or when color, strength, or certain other characteristics are required in yarn for special uses.

Russian customs statistics of the imports of cotton are misleading as regards country of origin. Much of the cotton and other merchandise brought into Russia is transshipped from British, German, and Danish ports and is credited to those countries, rather than the country of origin. Although in the customs returns Germany appears as one of the chief suppliers of cotton, practically all that imported from Germany is American cotton transshipped at Bremen or Hamburg.

Probably the most reliable statistics of the various cottons used in Russia are those collected by the Department of Commerce and Industry from official returns from the mills. According to these figures the quantity of the several kinds used in 1890, 1895, 1900, 1905, and 1910 was as follows:

Varieties.	1890	1895	1900	1905	1910
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
American.....	179,033,979	188,263,648	266,956,070	281,590,613	286,052,892
Russian.....	71,710,412	127,014,240	220,601,793	246,585,310	405,754,433
Egyptian.....	23,532,406	84,532,951	64,621,527	38,032,108	46,701,018
Persian.....	7,709,443	19,118,163	19,068,489	26,648,686	44,038,029
East Indian.....	5,824,374	10,553,546	6,588,070	9,388,022	15,758,516
Total.....	287,610,613	429,487,548	577,835,949	602,244,748	797,304,888

These figures do not include the waste purchased abroad and used chiefly in Poland in the manufacture of coarse goods. Much of this consists of comber waste and card strippings and fly. The total amount imported in 1900, 1905, and 1910 was 11,697,302, 11,113,060, and 21,546,714 pounds, respectively. Of the 1910 imports, there was consumed by the mills in Poland 17,147,789 pounds, or about 80 per cent.

RUSSIAN COTTON GROWING—METHODS OF CULTIVATION.

Russia has supplied an increasing proportion of the total raw material. While the native cotton used in 1890 represented but one-fourth of the total consumption, in 1910 less than half of the total was purchased abroad. To-day Russia ranks fourth among the cotton-producing countries of the world. There are two districts with climatic conditions suitable for the production of cotton, namely, central Asia, or Turkestan, comprising the districts of Ferghana, Syr-Darya, Samarkand, Transcaspia, with the tributary States of Bokhara, and Khiva, and the Caucasus district.

Cotton has been grown in central Asia since ancient times, when the staple was used solely for domestic requirements and only the indigenous variety was planted. The district where the cotton plant flourishes is the vast plain bordered on the south and east by spurs of the Himalaya Mountains, on the west by the Caspian Sea, and on the north by the forty-third degree of latitude. The climate has a distinctive continental character, with an annual rainfall ranging from

194.8 millimeters (7.7 inches) in the Ferghana district to 421.8 millimeters (16.6 inches) in Samarkand. The climate is dry, with high summer temperatures and scarcely any rainfall during the crop-making months. The lack of moisture has necessitated irrigation, water being supplied by numerous rivers which have their sources in the surrounding mountains. The soil is very rich and its fertility is still further increased by the alluvial deposits during the rainy season. The planting season begins in March and ends in the middle or last of April.

The soil is prepared almost entirely by hand and only in recent years have modern methods of planting and cultivating been introduced. Generally, furrows are made and connected in a zigzag manner in order to facilitate irrigation. After the soil has been thus loosened the fields are watered and the seed planted, 20 to 30 being used in each hill. The planting of so many seed is due partly to the small germinating power (about 60 per cent) and partly to the fact that the soil becomes hard after irrigation and individual seed can not pierce the crust which is formed. The plants begin to appear in 9 to 10 days after sowing and later the weaker plants are pulled out. The fields are irrigated several times during the summer and the process requires careful attention, for, owing to the peculiar properties of the soil and to the warm climate, an excess of moisture causes hardening of the ground and consequent danger to the plant. The summer is short and it is of the greatest importance to have only quick-ripening cotton.

VARIETIES OF COTTON—PROFITS—GINNING AND BALING.

Two entirely different types are produced in central Asia, the cotton from American seed and the indigenous variety. The latter has a hard, rough staple up to 23 millimeters (0.9 inch) in length and is similar in many respects to East Indian cotton, to which it is closely related. The bolls of the indigenous variety do not open like American cotton and in gathering they are broken off entirely; the opening of the bolls and ginning of the cotton are done almost entirely by hand. The cotton famine created by the American Civil War gave the first impetus to experiments in acclimating foreign varieties. The first trials were made in 1870 with sea-island seed, but the efforts failed, owing to the fact that this variety required a damp climate. Some 10 years later experiments were started with American upland seed and from the beginning the results were very satisfactory. This variety soon became acclimated and was quickly adopted everywhere, owing to its superiority to the indigenous plant. At present the latter variety is cultivated only in districts where for some special reason the American seed can not thrive.

In central Asia, as in America, the cultivation of cotton is principally in the hands of small farmers, who either own the land or rent it. In the latter case the landlord furnishes all the tools and implements and advances money to the tenant, with the crop as security. The native seems to prefer the tenant system to hiring himself out as a laborer, and this accounts for the few large plantations and the limited use of agricultural machines. The average profit of the tenant farmer is 120 to 180 rubles per dessiatine (\$23 to \$34 per acre), depending on the character of the tenant, the yield, and the market price of cotton. The average cost of planting, cultivating, picking,

and marketing the crop is 2.50 to 3 rubles per pood (3.5 to 4.3 cents per pound).

The picking season begins early in September and is finished with the arrival of frost in October. The dangers which threaten the crop are pests such as locusts, caterpillars, and worms. The size and quality of the Ferghana crop are frequently affected by the hot west winds that throw dry leaves and sand into the cotton, which impurities can not be entirely removed in the ginning process. The damage was greater than usual in 1911, and it is estimated that the crop will be considerably smaller than last season. The crop is ginned and baled in very much the same way as in the United States, but the bales are well covered with a heavy quality of jute bagging held in place by four wires. This method of packing gives good protection to the cotton. The bales were formerly packed by means of screw presses, but hydraulic presses are now used. The bales usually weigh 300 pounds and have a density of 30 pounds per cubic foot.

CHARACTERISTICS OF VARIOUS COTTON-GROWING DISTRICTS.

The Ferghana district produces the best quality of cotton and more than one-half the entire Russian crop. The so-called first-class cotton has an excellent white color and ranges between the full mid-dling and good middling American grade. Its staple is strong and silky, 29 to 30 millimeters (1.14 to 1.18 inches) long, and is very well adapted for warp yarns. Cotton is the favorite crop, and its trade forms the basis of the entire business life of the district. Numerous gins and cottonseed-oil mills have been established, and many of the cotton manufacturers of Moscow and Poland have their own buyers there.

Second in importance is the Syr-Darya district, in which the production has rapidly increased. American seed is used, but the quality of the cotton raised is inferior to that of Ferghana, and it is used principally in making weft yarn of low or medium numbers.

Samarkand ranks third, but the yield has remained stationary in recent years because the farmers have found it easier and more profitable to raise other crops. This is probably due to the availability of water for irrigation, which enables the farmers to inundate their fields when the locusts (which are a great pest in the country) threaten their crops. This practice is possible in the case of rice and other cereals, but can not, of course, be used in the cotton field. The cotton produced in this district is still lower in grade than those already mentioned. American and indigenous varieties have been planted side by side, hybridizing has taken place, and a cotton inferior to the American variety has resulted. The same is true of the Transcaspian district, with the single exception of the Imperial Estates, on which a fine quality of cotton is grown. More than 130,000 acres in Bokhara are planted to cotton, but because of special tax laws only the native variety is cultivated. The cotton grown in the Khiva district is of excellent quality and brings an even higher price than the Ferghana grade, but the yield is limited and is not rapidly increasing.

Russia possesses other cotton-producing country in the Caucasus district, lying between the Black and Caspian Seas. Soil and climatic conditions are similar to those in central Asia, and there are enormous stretches of land that can be cultivated as soon as irrigation is arranged. The practice of growing both native and American varie-

ties has had the same deteriorating effect on the quality of the fiber as was noted in the Samarkand and Transcaspian districts.

EXTENSION OF PRODUCTION—CUSTOMS DUTY ON COTTON—PRICES.

The figures in the foregoing table, showing the amount of Russian cotton consumed by the mills in specified years from 1890 to 1910, represent approximately the total crop, as the amount of cotton used by the peasants in the producing districts is not considerable. It will be noted that the mill consumption of Russian cotton was equivalent to 143,420 bales of 500 pounds each in 1900, while it exceeded 800,000 bales in 1910. The production in different districts varies from 270 to 325 pounds per acre. The crop for the 1911-12 season it is believed will fall short of last year's.

Extension of the cotton-growing area seems dependent entirely on the development of the irrigation system, and no important steps are being taken in this direction. However, the production is being gradually increased by improved methods of agriculture and intensive cultivation. It is undoubtedly true that the quality of the cotton is gradually deteriorating, owing partly to failure to exercise care in the selection of seed and partly to the mixing of the native and American varieties, as already explained.

Russia imposes a very high customs duty on raw cotton, the rate being 4 rubles per pood (5.7 cents per pound) on the gross weight, which makes the rate 4.25 rubles per pood (6.06 cents per pound) on the net weight of the cotton. This increases the cost of the raw material to the manufacturer, but since the tariff on cotton manufactures is correspondingly high the burden is not so keenly felt. Undoubtedly the high duty on cotton has stimulated the home production of the raw material. The entire amount of the duty is repaid to the manufacturer on all cotton yarn and cloth exported. This allowance, of course, is not made in the case of goods shipped to Finland and to certain parts of China, with which Russia has a special customs agreement.

The present (November, 1911) prices of American, Russian, Egyptian, Persian, and Indian cotton in Moscow are shown in the following table, and for comparison the prices of No. 38 weft and No. 32 warp and the average prices in 1910 of Nos. 30/32 warp and 38 weft yarns and of plain gray calico are given. The latter is 28 inches wide, is made of average 34s yarn, and weighs 6.16 yards per pound.

	Rubles per pood.	Cents per pound.
American cotton, December-March delivery	12 70	18.12
Russian cotton:		
Ferghana, first quality	12 40	17.09
Bokhara	11.00	15.00
Egyptian brown	17.45	24.89
Persian cotton:		
Machine ginned	11.00	15.00
Hand ginned	8.00	11.41
Indian cotton, Oomra No. 1	12.00	17.12
Nos. 32 warp and 38 weft yarn	23.25	33.15
No. 38 weft yarn (average price in 1910)	23.03	32.94
No. 30/32 warp yarn (average price in 1910)	23.26	33.16
Calico (average price in 1910)		16.06

¹ Per yard.

AMERICAN COTTON IN RUSSIA.

American cotton is sometimes bought through Bremen, Hamburg, or Liverpool firms and sometimes direct from America on c. i. f. terms, 6 per cent, with 1 per cent weight allowance. Payments are usually made in drafts dated 90 days from day of shipment. As one and one-half to two months is required for delivery, and as Russian manufacturers buy raw material to cover their needs several months in advance, the cotton is ordinarily paid for before it is used.

The various expenses incident to bringing American cotton into Russia and shipping it to Moscow from a Baltic port or from the border are, according to figures furnished by a prominent cotton dealer, as follows: Net duty per pood, 4.25 rubles; forwarding agent's expenses, reweighing, etc., 0.08 ruble per pood; banker's commission, 0.03 ruble; railroad freight, 0.25 ruble; interest and miscellaneous expenses, 0.04 ruble; total, 4.65 rubles per pood. This is equivalent to 6.63 cents per pound. The freight charge for bringing cotton to Russia, which varies from 45 to 55 cents per hundredweight, is not included in the above. The cost of transporting cotton from central Asia to Moscow, including freight, interest, insurance, and difference between buying gross weight and selling net weight, is 2.25 rubles per pood (3.21 cents per pound).

Strictly speaking, Russian cotton is bought for cash, but the purchaser may give bills of exchange for six to nine months at 6 per cent annual interest, and this is usually done. The present (November, 1911) low price of American cotton has brought the cost of the best grade of Russian cotton almost on a parity with the former, and the demand for the American variety will probably be greater this season than it has been for several years. In 1910 the average price of American cotton was 23.94 cents per pound, while that of the best grade of Russian was 22.25 cents. Of the home-grown cotton 83.4 per cent is used in the central district, a little over 8 per cent in the Baltic district, and the remainder in Poland and other sections.

The Persian cotton used in Russia is of many varieties, the staple being similar in character to Indian cotton, short but strong. It compares in some respects with the Russian cotton grown from home seed, but in consequence of mixing grades and of careless cleaning and sorting it is rather inferior. The Poland district utilizes it very largely in making waste products, 60,505 of the 88,076 bales imported in 1910 being consumed in this district. Indian cotton is not extensively used; only 31,000 bales, of which Poland used 70 per cent, were imported in 1910.

LABOR CONDITIONS.

The total number of operatives employed in the spinning and weaving mills in 1910 was 399,919, as compared with 279,766 in 1900. Women form 53.6 per cent of the total, while children under 15 years (half-timers) constitute only 10 per cent. The abundant supply of labor in Russia has led the cotton mills to adopt the two-shift system of work. The first shift usually works from 4 a. m. to 10 a. m. and from 4 p. m. to 10 p. m., and the second shift from 10 a. m. to 4 p. m. They alternate so that the shift that works during the first and last periods on the first day works during only one period

on the day following. Thus the working hours are alternately 12 and 6 hours, or an average of 9. Owing to the large number of church holidays that are observed, the average number of working days per month is only 22.8; the number of hours worked per year averaged 4,233 in 1900 and 4,173 in 1910. The schedule given above obtains in most of the cotton mills, and in practically all those of the central district. In the Baltic district and in Poland, however, where the supply of labor is not so large, the majority of the mills employ only one shift, which works from 10 to 11 hours per day.

AVERAGE ANNUAL WAGES OF OPERATIVES.

The earnings of cotton-mill operatives are considerably lower than in the United States, and even less than in other European countries. According to the report of the Inspector of Labor for 1910, the average annual earnings of operatives in the chief cotton-manufacturing districts were as follows:

Districts.	Average annual earnings.	Districts.	Average annual earnings.
Central district:		Baltic district:	
Moscow.....	\$118.96	St. Petersburg.....	\$147.29
Vladimir.....	98.80	Esthonia.....	140.59
Yaroslavl.....	100.45	Average.....	143.94
Kostroma.....	98.80	Western district.....	150.38
Average.....	104.22		

The average is considerably higher in Poland and in the Baltic district than in the central section, but the difference is more apparent than real, and is due partly to the fact already mentioned that the working hours are longer in the former districts, and partly to the fact that the operatives in Poland, St. Petersburg, and Esthonia, as a whole, are more efficient.

Operatives are generally paid by piece, and in mills working two shifts the production of the spindle or loom is awarded equally to each of the two operatives tending the machine. It would appear that this system would cause complaint among the workers, but apparently it does not, and the managers of several mills stated that it actually tended to increase production. The more efficient weaver, for example, "gets behind" the operative on the same set of looms who is inclined to neglect his work, in order that the total amount of cloth woven may be larger, thus increasing the earnings of both weavers. Moreover, wherever possible, two members of the same family operate a set of looms or the same spinning frames, etc. The arrangement is particularly satisfactory in the case of a family with small children; the husband takes one shift and his wife the other, and the children in the home are never left alone.

RANGE OF DAILY WAGES.

Wages necessarily vary in different mills according to local conditions and to the class of yarn or cloth manufactured. The following table, which has been compiled from figures obtained at different

mills and from cotton manufacturers, gives an idea of the daily wages of the operatives in the various departments:

Operatives.	Daily wages.	Operatives.	Daily wages.
Lapper tenders (men).....	\$0.46-\$0.64	Ring spinners, one operative to 500 spindles (women and girls).....	\$0.33-\$0.46
Card grinders (men).....	.36- .64	Mule spinners, overseers (men).....	1.03- 1.30
Card strippers and lap carriers (men)...	.41- .52	Big piecers, one to 1,000 spindles.....	.41- .61
Can tenders (mostly girls).....	.26- .31	Little piecers (boys).....	.36- .41
Drawing frames, 12 deliveries (women)	.36- .46	Scavengers (waste boys).....	.21- .26
Combers (women).....	.31- .51	Spooler and winder hands (women)...	.31- .41
Slubber operatives (men and women)...	.36- .46	Beam warper operatives (women).....	.46- .56
Intermediate operatives (men and women).....	.36- .50	Slasher tenders (men).....	.52- .67
Fine roving operatives (men and women).....	.36- .50	Draw-in hands (women and girls).....	.46- .56
Back tenders or creelers, one to every 4 or 6 frames (boys).....	.26- .31	Weavers.....	.41- .60
		Weave-room overseer, one to 48 looms.	1.03- 1.23

Operatives in the lapper room usually tend 2 machines; card grinders, strippers, and lap carriers, who tend the backs of the cards, look after 40 to 60 cards; can tenders are paid at the rate of 3 kopecks (1.54 cents) per card, and usually tend 15 to 20. One woman looks after 12 deliveries of drawings, or 2 combers of 8 deliveries each. Slubber hands tend 1 frame, while on intermediates, fine roving, and jacks 2 frames to each operative is the rule, with a back tender or creeler to every 4 or 6 frames. Ring spinning frames usually have from 400 to 500 spindles each, and one operative tends 2 and sometimes 3 sides.

INFLUENCE OF WELFARE WORK ON WAGE SCALE.

The wages in the foregoing table are very low apparently, but attention is drawn to the fact that the Russian operative is better cared for by the employer than those in many other countries. Many mills house their operatives rent free, while others charge only a nominal sum. The manager of one mill in the Moscow district stated that operatives not housed by the mill were paid 2 rubles (\$1.03) extra per month. Free schools, churches, hospitals with free medical attendance, theaters, parks, and playgrounds are provided and maintained by the manufacturers, often at great expense. Nearly every mill has its own bakery, from which bread is furnished to employees, sometimes free and sometimes at about one-half the market price. It is also not unusual for the mill to sell other provisions at cost prices.

In their welfare work the manufacturers have been actuated partly by altruistic motives, but largely by necessity. In the United States and other countries efforts to ameliorate the condition of employees have been due largely to the keen competition for labor and the desire to provide pleasant surroundings for the employees, and thus secure a steady, well-contented class who will remain at the mill. In Russia the same purpose is in view, but the employers are actuated not so much by the scarcity of labor as by the fact that the operatives come from the peasant class, who regard the mill village not as their home, but as a temporary residence. To the peasant home is the little farm, often many miles from the mill, to which he expects some day to return. Undoubtedly the manufacturers by their welfare

work have been able to retain many people at the mills and for their trouble and expense have secured some return in the low scale of wages.

The foreigner who goes among the cotton mills with preconceived notions as to the laboring classes will be forcibly impressed by the good appearance and general condition of the operatives.

I inspected several of the mill tenements, hospitals, and schools and found the tenements clean and sanitary, provided with electric light, hot and cold water, and neat and attractive in appearance. Hospitals are built at considerable expense and are equipped with every modern convenience; capable physicians and surgeons are always in attendance. The operatives of the mill when sick may go to the hospital and receive the very best of care without cost. At one mill a new hospital was being built at a cost of \$250,000; at another an amusement park and theater for the use of the operatives was just being finished at an expense of \$75,000. The object of these amusement features is to provide recreation for the mill workers when they are idle in order to combat the tendency to drink vodka to excess. The activity of the cotton manufacturers is but one phase of the temperance movement in Russia to-day, which has for its object the provision of clean and wholesome forms of amusement for the working people in their idle hours. The presence of many Englishmen as managers, foremen, or clerks has led to the organization of football teams, and the popularity of this sport is evidence of the wisdom of the employers.

It has been recently estimated that the Russian cotton-mill operative spends 14.5 kopecks (7.47 cents) per day for food. In the Russian Church calendar there are 180 fast days on which no meat, eggs, or butter can be eaten. Owing to this fact the food of the Russian laborer consists chiefly of bread, tea, and vegetables. Bread, as has been stated, is furnished by the mills either free or at a very low price, and tea is also sometimes provided.

LAWS IN REGARD TO LABOR.

The laws in Russia in respect to labor in cotton mills are essentially as stringent as those in other industries. The principal provisions of these laws are as follows:

For the purposes of the law night work is reckoned as from 9 p. m. to 5 a. m. for mills operating with one shift and from 10 p. m. to 4 a. m. for those with two shifts.

Where one shift is employed, the hours of labor must not exceed 11½ in each 24, and on Saturdays and the eves of holidays the hours must not exceed 10, and in all cases there must be an interval of rest of not less than 1 hour.

When work is carried on for 18 hours a day with two shifts of operatives the working hours in each 24 may be increased to 12, provided that in a fortnight the average work time for each operative does not exceed 9 hours.

The operatives must be allowed time for meals at least once in 6 hours. When the work time between two intervals of rest exceeds 6 hours, and any other distribution of time is impossible, the workmen must be allowed to take their meals during work time, and a place for meals must be fixed by shop regulations.

Children under 12 can not be employed. Minors from 12 to 15 can not be engaged for more than 8 hours per day exclusive of the period assigned for meals, school, and rest; work must not occupy more than 4 successive hours, and is prohibited from 9 p. m. to 5 a. m. Where two shifts are used during 18 hours they can be employed 9 hours, but work must not occupy more than $4\frac{1}{2}$ consecutive hours. Minors from 15 to 17 and women can not be employed at night.

The conditions of the agreement made between employer and employee are stated in a book, a copy of which is given to each worker, and must be delivered to him seven days after his employment. In this book are noted all payments to be made by the employer and all fines imposed for idleness, neglect, etc. When the length of engagement is indefinite, either party may break the agreement by giving a fortnight's notice. The laborers must be paid not less frequently than once a month if the engagement is for a longer time, and at least twice a month if the contract is for an indefinite time.

The agreement can be annulled (1) if the workman is absent from work three days consecutively, or six days in one month, without just cause; (2) if the workman is absent from his work during two weeks running for any cause whatever; (3) for rudeness or misconduct, if such menace the interests of the employer or the personal security of anyone connected with the factory; (4) if the laborer for any act be sentenced to imprisonment; (5) in case of the laborer contracting a contagious disease. A discharged laborer may appeal, in the case last mentioned, to the factory inspector or to the court of justice, which fixes the compensation to which he is entitled if his complaint is sustained.

The administration may fix a list of fines to be imposed on the employee for (1) negligence, (2) idleness, (3) infringement of rules. Each act subject to a fine must be stated in special tables, with the amount of said fine, and no fine may exceed one-third the laborer's wage. This list must be approved by the factory inspector, and all fines collected under it must go to a fund for the benefit of the operatives.

These laws have been in effect since 1898, and factory inspectors are employed to see that they are observed, and, in general, to act as an intermediary between employers and workmen.

COMPENSATION FOR INJURIES—LABOR ORGANIZATION.

Compensation to laborers in case of injury is regulated by the law of June 2, 1903, under which the employer is obliged to compensate the laborer and the members of his family; but the employer is relieved of this obligation when he can prove that the accident was the fault of the laborer. Compensation is in the form of an aid, or pension, paid from the date of injury until the employee's full restoration to health. For complete disability a pension is allotted amounting to two-thirds of the annual wage, and for partial disability according to degree. In case death results from an accident a pension is paid to the deceased's family, one-third going to the widow, one-third to the children, and one-third to the brothers and sisters.

Medical and funeral expenses are paid by the employer, and in cases of factories employing 1,000 workpeople or more, infirmaries or hos-

pitals must be provided, the size of which is determined by the number of employees.

All the laws appear to be strictly observed by the cotton mills, and there is a notable absence of small children in the factories.

There is no organization among the cotton-mill operatives; in fact, such organizations are contrary to the laws of the country, which provide heavy penalties of imprisonment for originators of or participants in a strike. Nevertheless there have been frequent strikes, although the number is considerably less than formerly. During the disturbances throughout Russia in 1905 and 1906 the manufacturers suffered heavily and the damage to their property was considerable. Conditions have greatly improved since then, but at many of the mills a force of police is employed, often supplemented by a detachment of Government troops. By intervening between employer and employees in cases of dispute the labor inspectors have had an influence in preventing strikes.

The improved condition of the operatives has not been brought about by strikes, however, and wages have not had more than a normal increase in the past 10 years. Strikes have had more of a political nature than a well-formulated and fixed determination to secure higher wages, or a protest to the manufacturer, as in the United States.

Time will doubtless bring a better feeling between the employer and the workers, because the cotton industry in Russia has undoubtedly done much toward improving the condition of the laboring class and developing the people along educational, moral, and industrial lines.

NATURE OF OUTPUT AND COST OF PRODUCTION.

One of the chief classes of goods made in Russian mills is plain sheeting, which is called mitkal or biaz. The former is the cheaper grade, although it is made in a variety of constructions, from ordinary 48 by 44 cheese cloth to a cloth similar to the regular 36-inch, 56 by 60, 4-yard sheeting. It is sold both in the gray and bleached, and is usually narrow (25 to 27 inches) like the bulk of the cloth woven in Russia. Biaz is of the same width and in the cheaper qualities is identical with mitkal. Three samples of each of these fabrics are furnished (see list, p. 48), and they will give an idea of the quality and construction of the goods. The yarn is usually 32s warp and 34s filling.

The coarsest quality of mitkal is 26/27 inches wide, 48 by 48 picks, and retails for 10 kopecks per arshine (6.6 cents per yard). The better qualities are 25/26 inches, 60 by 56 picks, and 26/27 inches, 60 by 56 picks. The former is bleached, and sells for 14 kopecks per arshine (9.3 cents per yard), while the price of the latter, in the gray, is 12 kopecks per arshine (7.9 cents per yard).

The three grades of biaz are as follows: Coarse, 27/28 inches wide, 56 by 56 picks, unbleached, retailing at 17 kopecks per arshine (11.3 cents per yard); medium, 24/25 inches wide, 60 by 44 picks, bleached, retailing at 16 kopecks per arshine (10.6 cents per yard); fine, 27/28 inches wide, 56 by 48 picks, bleached, retailing at 18 kopecks per arshine (11.9 cents per yard).

DYED AND PRINTED GOODS.

In dyed and printed fabrics the article most widely sold is the so-called koomach. If one enters a store and asks for this he will ordinarily be given a cloth that is dyed in a bright solid-red color, although in recent years it has been made in other colors, such as indigo, dark blue, and green. Among the Russian peasants red is a favorite color, and it was among the first colors used, the people from Asia Minor and Turkey having brought the Turkey red dye up the River Volga and sold it to the natives early in the eighteenth century. The red koomach is extensively used throughout Russia to-day, not only by peasants but by the working classes in the cities. The blouses which one often sees on the porters in the hotels are made of this material, and it is also used by the women for dresses. The cloth is made 24 inches wide (finished), 96 by 72 picks, and generally of 32s warp and 38s weft or 34s warp and 36s weft yarn. Samples of the red, blue, and indigo styles are furnished.

Chintz is another printed cloth that is in good demand. The word chintz is derived from a Hindu word meaning variegated. It is a cloth usually printed in many and various colored designs with a Persian effect, and is used for curtains, upholstery, and other household purposes. In Russia, however, the term has a much broader application, and the cloth is printed in simple designs, stripes, checks, flower effects, and the like, and takes the place of a cheap gingham, which is not made in that country. The three samples furnished will give a good idea of the fabric. No. 10 is a Persian design printed in seven colors, is 25 inches wide, 80 by 56 picks, and retails for 20 kopecks per arshine (13.24 cents per yard). It has a rather stiff finish. The other two (Nos. 11 and 12) are finished soft for dresses, and are 25 inches wide, 80 by 56 picks, and 24 inches wide, 56 by 56 picks; they sell for 18 and 12 kopecks per arshine (11.9 cents and 7.9 cents per yard), respectively.

Another fabric that may be considered characteristic of the Russian cotton industry is boomazey. It is printed both in elaborate Persian designs and in plain figures and always has a slight nap or flannel finish on the side that is not printed. These goods are usually of twill construction and are used for shirts, dresses, etc., in winter, taking the place of wool because they are cheaper. Three grades are represented in the samples furnished. The first (No. 13) is 23/24 inches wide, 72 by 44 picks, three-up-and-one-down weave, and retails at 14 kopecks per arshine (9.3 cents per yard); the second (No. 14) is 22 inches wide, 72 by 44 picks, two-up-and-one-down construction, and sells at 17 kopecks per arshine (11.3 cents per yard); the third (No. 15) is 24 inches wide, 64 by 56 picks, two-up-and-two-down, or regular flannelet, construction and retails for 24 kopecks per arshine (15.9 cents per yard). The price of the goods seems to depend more on the printing design than on the construction.

OTHER PRODUCTS.

The goods described are those deserving particular mention because they are typical of the industry. Because of the high tariff and the duty on raw cotton prices are undoubtedly higher than for similar

fabrics in the United States. Other fabrics manufactured are print goods, which are usually 28 inches wide, 74 by 70 picks, made of 34s warp and 38s filling, and weighing a little over 7 yards to the pound; sateens; muslin; percale; piqué, which is usually napped on the under side; imitation woolen goods; cheviots; reps; cretonne; curtain and upholstery goods; head shawls and handkerchiefs; corduroy and velvet, which are dyed in the piece and generally cut by hand; and also such finer goods as lawns, batiste, fine bleached muslin, madapolam, damask, and leno fabrics, napkins and tablecloths, and mercerized goods. Most of the mills are engaged in making the cheap and coarser grades, because they are in the greatest demand.

COST OF PRODUCTION.

The cost of production in Russia varies, of course, in different mills. For example, I found that 32/34s warp yarn costs from 4.40 to 5 rubles per pood (6.27 to 7.13 cents per pound). These figures include loss from waste and all expenses of production. In other words, the manufacturer must add these amounts to the cost of cotton at the mill in order to come out even. In one of the best-managed mills I found that the cost of producing 32s warp was 6.27 cents per pound, divided as follows:

	Rubles per pood.	Cents per pound.
Cost of raw cotton at the mill.....	12.50	17.83
Loss of waste less recovery from reworked waste (12 per cent).....	1.50	2.14
Average cost of fuel.....	.50	.71
Running expenses:		
Supplies, taxes, insurance, interest, packing, and freight.....	1.50	2.14
Labor.....	.80	1.14
Salaries.....	.10	.14
Total.....	16.90	24.10
Cost of cotton.....	12.50	17.83
Cost of producing yarn.....	4.40	6.27

The labor cost is very low, but the item of interest is high, it being the chief item under the head of supplies, etc. While the labor cost is therefore much lower than in the United States, the total cost of production is perhaps not more than 1½ to 2 cents per pound less. The total weaving cost of regular print cloth was given to me as 90 kopecks per piece of 45½ yards, weighing 8 funts. This is equal to 6.4 cents per pound. However, this cost is probably higher than the average, because at the present time the weaving mills are charging only 80 kopecks per piece, weighing 8 funts (5.7 cents per pound). A weaver working on 28-inch, 74 by 70 pick goods, weighing 7.25 yards per pound, is paid 35.6 kopecks (18.3 cents) per piece of 45½ yards, and he usually weaves one piece per day on each loom, running at a speed of 220 picks per minute. The present market is making it more profitable to spin than to weave, as the price of yarn is about 4 or 5 cents per pound above the cost of production.

METHODS OF SELLING—PROFITS IN THE INDUSTRY.

The larger mills sell their products through their own stores and warehouses in the large cities. Others sell through brokers, who charge a commission of one-half of 1 per cent. There are no special rules among the manufacturers governing prices or conditions of sale. Contracts are usually made for 8 months, and the terms are sometimes 6 and sometimes 12 months, with interest at the rate of 6 per cent per annum.

The cotton industry has enjoyed great prosperity in Russia, and five or ten years ago profits of 30, 40, and 50 per cent were not unusual. In 1905 and 1906, however, the mills suffered considerably from the prevailing disturbances, and in 1907 and since that year the increased cost of cotton has diminished the earnings. The president of the Cotton Manufacturers' Association stated that the average earnings in the past 10 years had been a little over 7½ per cent. This, however, is the amount distributed to shareholders; the actual profits have been more. The depression in the industry in all parts of the world has certainly not embarrassed the Russian manufacturers to the same extent as those in either the United States or England, and no appreciable curtailment of production has taken place. The failure of the crops in 1911 is expected to affect the industry, and the recent fall in the price of cotton will hurt those manufacturers who have on hand a large supply of cotton bought at high prices. However, the Russian industry seems to be on a sound basis and in all of the mills I visited I heard no complaint as to conditions. Under the ample protection afforded by the tariff, cotton manufacturing will probably continue to grow in Russia to keep pace with the constantly increasing demand for cotton goods.

USE OF WASTE.

In Russia practically all the cotton mills work up their waste, while in some districts there are mills devoted exclusively to the manufacture of waste products. It is not always advisable or profitable for a small mill to attempt to work up the waste produced; the larger the mill the more economical it becomes. Russian mills are nearly all large and, moreover, are generally equipped to manufacture a wide range of yarn and cloth; it is easy, therefore, to use the waste in the coarser counts and cheap fabrics. Furthermore, nearly all the mills operate mule spinning, and it is on the mule frame that waste can be most advantageously spun, because the material consists of short and varying lengths of fiber and can not be spun on the ring frame without excessive twist.

In the Lodz district of Poland the manufacture of waste products is an important branch of the cotton industry. Not only is the waste from Russian mills utilized, but large quantities of strippings, fly, and comber waste are imported, chiefly from England. The total quantity of imported waste consumed in Poland in 1910 was 475,008 poods (17,153,869 pounds); the consumption in the central district was 106,094 poods (3,831,351 pounds), and in the Baltic district only 15,710 poods (567,332 pounds).

The system of machinery usually employed is the condenser, as opposed to the coiler system, and a number of the mills have all the equipment necessary for spinning yarn of low numbers from such waste as sweepings, motes, fly, strippings, scavenger, and hard waste. The combined opener and picker used is about 12 feet long and 30 inches wide, and is made in England. It is very similar in operation to a regular cotton-mill picker, except that the beaters, of which there are usually three, consist of cylinders about 18 inches in diameter fitted with a number of short projecting spikes. All sorts of waste are fed into the machine and the action of the beaters and the strong draft of air separate the fiber from the dirt in the case of motes, sweeps, fly, and similar waste, and take out the twist in hard waste and tear it up so that it can be reworked. Often the various kinds of waste are not separated but are run in together in order to obtain a better mixing.

In some cases the waste after being thus prepared is put in a general mixing of low-grade cotton in the proportion of about 1 to 10 and is made into coarse yarns, ranging in number from 6s to 14s, through the ordinary processes of spinning. In several of the mills visited, however, there was a complete special equipment for spinning waste. The cards used, which are simply modifications of the woolen card system, consist of a breaker and a finisher working together. The stock from the picker is sometimes fed on an apron or through a hopper and sometimes from laps. The slivers as they come from the cards, wound on spools, are carried direct to the mule without going through any intermediate processes and are there spun into yarn. The mules are without draft rollers and the sliver passes through only one set of self-weighted rolls and is delivered direct to the spindle.

In Poland a large quantity of vigogne yarn is produced for weaving imitation woolen cloth. Strictly speaking, this class of yarn is made from cotton with a small proportion of wool, the word "vigogne" being derived from the name of the South American animal from which the wool is obtained. But in Poland, as in Germany and Italy, it is made entirely of cotton and is so worked on the woolen card system that it is an excellent imitation of the real article; in fact, it is sometimes difficult to discover without very close examination that no wool has been used. Besides imitation woolen goods, waste is used for making cleaning cloths, cheap towels and blankets, etc., and the coarse grades of gray goods, which are sometimes sold as woven but which more frequently are dyed and printed.

EMIL ZÜNDEL CO.

The great demand for printed and piece-dyed goods has given an impetus to the dyeing and printing industry, and it has been brought to its present position very largely by Alsatians, a number of whom, as already mentioned, were left in Russia as prisoners after the retreat of Napoleon in 1812, and who were the first to introduce the art of printing in a modern sense. Some of the mills operate their own printing plants, in which either Frenchmen or Germans are largely employed, but the most important print works in Russia is that of Emil Zündel, of Moscow.

The Zündel plant was founded in 1825 by an Alsatian, and in its early days printing was done by means of wooden boards. It was

not until 1840 that printing machines were adopted. The present owners of the plant purchased it in 1874 and started with a capital of 1,500,000 rubles (\$772,500). To-day the firm has a capital of 6,000,000 rubles (\$3,090,000), with a reserve fund of more than 1,000,000 rubles (\$515,000), and owns property valued at more than 14,000,000 rubles (\$7,210,000). The company's land comprises more than 400 acres; 2,500 operatives are employed in the print works, and 5,000 in a cotton mill which was acquired in 1907.

Thirty printing machines, with a capacity up to 16 colors, are operated, and in 1910 the total production was 2,500,000 pieces of 58 arshines (45.1 yards) each. Besides printing, the firm bleaches, mercerizes, and naps. Very fine work is done in silk-finished goods, for which a Schreiner machine is used. Another specialty is "blotched" work, in which the colors are developed by steaming after the cloth has been printed. In 1910 more than 36,000 tons of crude naphtha (ton of crude petroleum=about 7.1 barrels) were consumed in producing the 4,000 horsepower used in the two establishments and for furnishing heat, light, and steam.

CAPACITY AND OUTPUT OF MILL—MARKETING SYSTEM.

The cotton mill, which is located in the Moscow Government, has 112,816 spindles and 3,188 looms, consumes 12,000 bales of American, Egyptian, and Russian cotton annually, and produces 362,000 pieces of print cloth, batiste, sateen, muslin, and percale, all of which is dyed, printed, or bleached at the finishing works. In the latter the most expert laboratory chemists, skilled designers, and engravers are employed, and they constantly seek to develop new coloring processes and improved methods of dyeing and finishing. The managers are Alsatians, and the chemists are German, French, and Alsatian.

In its welfare work the firm has done much to improve the condition of the operatives and the manager stated that more than \$1,000,000 had been spent in providing hospitals, churches, schools, etc. A fund of more than 500,000 rubles (\$257,500) is maintained from which pensions are paid to the workers on leaving the service after a certain age. In the savings bank which has been established the deposits of the operatives amount to nearly \$400,000. A cooperative store is conducted where provisions are sold practically at cost.

In marketing its goods the Zündel company exercises the same care and employs the modern systematic methods that characterize its manufacturing and printing plants. At first the goods were sold through wholesale houses, but in recent years they have been marketed direct. Warehouses and stores have been erected all over the Russian Empire, in the cities of Moscow, St. Petersburg, Warsaw, Riga, Helsingfors (Finland), Odessa, Omsk (one of the largest mercantile centers of western Siberia), and others. Branch houses have also been established beyond the Russian border, notably at Harbin, an important trading center with respect to the Chinese trade. More recently a branch has been opened at Sofia, Bulgaria, while there are agents in Paris and Hamburg and in the Near Eastern markets of Turkey and Persia.

The Siberian Railway has been a strong factor in developing the trade of this firm and others. The establishment of better means of

communication has brought the people nearer together and has made it possible for the customers to get quicker deliveries than in former times. The Zündel company usually sells on terms of 6 months' credit, whereas in other days 12 to 18 months was necessary because of the great distances goods had to be conveyed by means of poor transportation facilities.

KRENHOLM MANUFACTURING CO.

The most important mill in Russia and one of the largest in the world is that of the Krenholm Manufacturing Co., situated at Narva, about 75 miles from St. Petersburg. Some of the figures in regard to this plant are interesting. The company owns 32,000 acres of land and employs 12,000 people; 74,660 bales of cotton were used in 1910, from which there were produced 34,861,796 pounds of yarn and 159,994 pieces of cloth (average 45 yards each). The wages paid in 1910 amounted to \$1,370,000. For developing power for driving, 11 water turbines with a combined horsepower of 8,550 and supplementary steam engines of 700 horsepower are employed. The growth of the plant is shown in the following table:

Years.	Spindles.	Looms.	Production of yarn.
			<i>Pounds.</i>
1859.....	10, 440	.....	1, 372, 765
1860.....	34, 431	516	2, 116, 631
1866.....	104, 211	960	3, 976, 415
1871.....	177, 185	1, 578	7, 965, 909
1881.....	289, 131	2, 177	16, 167, 746
1891.....	389, 152	2, 136	21, 262, 900
1901.....	458, 380	2, 500	22, 243, 914
1910.....	472, 500	3, 672	34, 861, 796

MILL CONSTRUCTION AND EQUIPMENT.

The Krenholm mill was founded in 1857 by the pioneer of the Russian cotton industry, Ludwig Knoop, and is located on an island and along the banks of the River Narova. The sea is only about 10 miles distant, and in the harbor at the mouth of the river large cotton warehouses have been erected where cotton, imported direct from America or Liverpool, is stored and brought up the river to the mill as needed. The Narova, just before it runs into the sea, has a fall of about 27 feet with a flow of 1,770 cubic feet per second and this provides a splendid source of power. The machinery is distributed through three separate buildings, which are of brick and stone construction, two of them being five stories and one four. It is interesting to note that the last mill, devoted entirely to spinning, is of American construction, the floors and supports being of wood. The manager stated that he is well pleased with it, that there is very little vibration and that he considers it as fireproof as the regular Russian type of building in which no wood is used.

The managers and assistant managers of the mills are English, and this was everywhere apparent, inside and outside the plant. In fact, it is practically an English mill on Russian soil with Russian operatives. The carding and spinning machinery is from the firm of Platt Bros., in England. Part of the looms are English, but most of them were made by the firm in its up-to-date foundry and machine works, which are an important adjunct of the mill. Northrop looms are not in use, except a few for trial purposes; the manager stated that

the low cost of labor had not made it advantageous to install them, and this opinion was confirmed at other mills. However, this firm quite recently placed an order for two American warp tying-in machines. Old machinery is constantly being replaced by new, although its life at an effective production is longer than that of the average American machine. For example, I saw a few spinning frames in this mill that had been running 18 hours per day for about 30 years, while some machinery installed in 1860 and 1865 was just being replaced. The remarkable fact is that the production is hardly less than from new frames. I timed the front roll on one of the spinning frames mentioned and found that it was running at 130 revolutions per minute on 34s weft, which is only slightly under the standard speed as set down in the catalogue by the makers.

In the opening and mixing room the conveyer belt and blower systems are used. Cotton from a number of different bales is fed into a hopper, where it is thoroughly mixed, and is then carried on an endless apron to the various bins, from which it is conveyed to the pickers through blower pipes.

WAGES—WORKING HOURS—PRODUCTION.

In the card room two card grinders were employed on 44 cards and earned 60 cents per day, while the lap carriers and can men were paid 41 cents for tending 15 cards. Roving-frame operatives received 54 cents per day on an average, and one man ran one slubber of 80 spindles, one intermediate of 124 spindles, or two fine frames of 160 spindles each, but on the last two machines one creeler at 31 cents per day was employed as assistant. Ring spinners were tending 632 spindles at a daily wage of 38 cents; on mules the overseer received \$1.17 per day for looking after 1,250 spindles, big piecers 38 cents, and little piecers 26 cents. Daily wages on spoolers were 48 cents (36 ends per operative) and on twistors 40 cents (404 spindles per operative). A hand who was running one beam warper earned 61 cents, and slasher tenders were paid \$1.51, and one man and an assistant at 71 cents looked after one machine. Weavers were earning from 40 to 60 cents per day, dependent on the production. Practically all work is done by the piece and the foregoing figures are the average earnings as stated by the manager.

The laborers are partly Russian and partly Esthonian; the latter are the more efficient and this mill's production is higher than that of the average mill in the central district; wages, however, are correspondingly higher. The company is very active in looking after the welfare of the workpeople. Both a Russian church (built at a cost of \$250,000) and a Lutheran church for the Esthonians are provided. Schools, in which there are 1,200 children, are maintained and a new hospital is being erected at a cost of nearly \$250,000. The mill also houses the employees at a nominal rental and 500,000 pounds of bread are baked each month and sold to the people at 1½ kopecks (0.64 cent) per pound, which is one-half the market price, while other commodities are furnished at very low prices.

In one of the mills the working hours are 10½ per day, with one shift, the schedule being from 6 a. m. to 12 noon and from 1.30 to 6 p. m. In the other mills two shifts working 9 hours each are employed, one from 4 a. m. to 1 p. m. and the other from 1 to 10 p. m.; the two shifts alternate each day on the morning and evening

period. On Saturdays and days preceding holidays, however, the hours are from 4 a. m. to 12 noon and from noon to 8 p. m.

Seventy per cent of the spindles are engaged in making yarns for sale principally among weavers in the St. Petersburg and Moscow districts. A specialty of the mill is 90s ply yarn, made from Egyptian yarn, for the rubber-tire manufacturers. The range of yarns produced is very wide, running from 3s to 90s, and about 330,000 of the spindles are mules. In shipping yarn I noticed that they used beams made entirely of wood instead of the beam with iron heads and a wooden barrel employed in the United States. The spinner in Russia usually pays the freight on the yarn and the returned beams, and it is claimed that the lightness of the wood beams effects a saving in freight, while they are sufficiently strong and do not injure the yarn. The cloth woven consists mainly of print cloths of various constructions and sateens, both woven from 34s warp and 38s weft. Practically all the goods are shipped to a printing works in Moscow, in which the firm has a large interest.

VIKUL MOROZOFF & SONS MANUFACTURING CO.

In the central district one of the most important mills is that of the Vikul Morozoff & Sons Manufacturing Co., situated at Zuevo, Vladimir Government, about 50 miles from Moscow. This is only one of the several mills founded by the firm of Morozoff, which is second in importance only to that of Knoop in the development of the Russian cotton industry. "Morozoff cloth" is a brand of cheap calico that is known all over Russia and enjoys a large sale. This mill operates 155,456 spindles and 2,503 looms, and employs 15,000 workpeople, part of whom are engaged in digging peat in the extensive bogs which the company owns and from which fuel is obtained. As at the Krenholm mill, an English manager is in charge, and all of the machinery is English except the looms, which are largely of Russian make. Ten thousand horsepower is developed at a cost of 80 rubles (\$41.20) per horsepower per year of 4,620 hours. Steam power is now used to generate electricity, and motors are being installed on the individual drive system.

WAGES—BONUS SYSTEM.

Operatives are paid by the piece, as in the majority of mills, and the average daily earnings are as follows:

Operatives.	Average daily wages.	Operatives.	Average daily wages.
Scutcher room, one man to 2 machines.	\$0.58	Spinning room—Continued.	
Card room:		Mule frames, one operative to 1 mule (1,200 spindles).....	\$0.77
Overseer, one to 65 cards.....	.85	Big piecers on mule frames, one to 1 mule.....	.64
Card grinder, one to 65 cards.....	.64	Little piecers on mule frames, one to 1 mule.....	.51
Lap carrier, one to 32 cards.....	.46	Spoolers, one operative to 30 spindles.	.43
Can tender, one to 32 cards.....	.38	Twisters, one operative to 550 spindles.....	.51
Combers, one woman to 24 heads.....	.53	Warpers, one operative to 1 machine.	.51
Drawing frames, one woman to 24 deliveries.....	.37	Slasher tenders, two operatives to 1 machine.....	.63
Slubbers, one hand to 1 machine (90 spindles).....	.46	Draw-in hands.....	.43
Intermediates, one hand to 1 machine (140 spindles).....	.46	Weavers (men), on 2 looms.....	.51
Fine frames, one hand to 2 machines.	.46	Weavers (women), on 2 looms.....	.43
Creelers, one boy to 6 frames.....	.36	Operatives in bleaching, dyeing, and finishing department, average.....	.46
Spinning room:			
Ring spinners, one operative to 1 frame (500 spindles).....	.43		
Doffers, one to 6 frames.....	.31		

The manager stated that wages were about 25 per cent higher in this mill than in the average factory of the district, owing largely to its being situated in a village in which there are several mills, making the demand for labor greater. The mill, however, was in very fine shape, and the production was high. The bonus system is used; that is, the operative is paid a premium in addition to his regular earnings if the production exceeds a stated amount. I found this system in vogue in numerous mills, and it seemed to be working satisfactorily. At one place a somewhat different method was employed. There was a graduated scale of premiums dependent on the annual production of the mill, and at the close of the year the sum awarded was divided among the operatives in proportion to their earnings. This system has the advantage of encouraging the whole body of employees to increase production, but, on the other hand, to the average cotton-mill operative, the promise of a reward at some distant date may lack effectiveness as an incentive to increased effort. The bonus system seems at its best when the rewards are made at sufficiently frequent intervals to impress upon the laborer the value of closer attention to work.

WORKING HOURS—WELFARE WORK—PRODUCTION.

Two shifts of operatives are employed at this mill, the first going on from 4 a. m. to 8 a. m. and returning to the mill at noon and working to 5 p. m.; the other shift works from 8 a. m. to 12 noon and from 5 p. m. to 10 p. m. Each set thus works 9 hours each day, but has an intervening rest. On Monday morning work does not start until 6 a. m. and on Saturday the mill stops at 6 p. m.

Welfare work is carried on here to a marked degree. Tenements with heat, light, and hot and cold water are furnished, rent free. In the splendid day school I found 35 teachers and nearly 1,800 children, while in a night school 800 men were enrolled. In the hospital 7 doctors are employed, and attendance and medicines are, of course, free. The mill store furnishes provisions at cost prices. A splendid park and a theater are just being completed at a cost of \$75,000. All sorts of sports are encouraged, and a football team, which arouses great enthusiasm among the mill people, is given financial support by the firm. One of the managers of the mill with whom I talked on the subject of welfare work expressed a desire for changed conditions which would not necessitate the mill maintaining so many outside activities and would permit a greater concentration of forces on the purely manufacturing side of the business. It was his opinion that it would perhaps be better to pay the operatives higher wages and provide them with good living quarters, but not furnish them with so many other things.

About 36,000 bales of cotton are used annually by the mill, of which about 40 per cent is American and Russian and 60 per cent Egyptian. The latter is combed and made into fine yarns up to 120s and 140s, while a good trade has been built up in sewing thread. Very low counts of yarn, into which all the waste of the mill is worked up, are also spun and later woven into moleskins, cleaning cloths, and other coarse fabrics. A variety of goods is manufactured, including cambric, fine lawns, sateens and satinettes, imitation woolen goods, print cloth, mercerized goods, velvets, and corduroys. All of these goods are finished in the firm's own dyeing and printing plant.

OTHER PROMINENT MILLS.

The Koonshin Manufacturing Co., at Serpukhov, Moscow Government, is one of the most up-to-date mills I visited. There are 115,000 spindles in the mill, of which 44,000 are mules, and 4,100 looms. About 25,000 bales of cotton are consumed annually, consisting of 20 per cent Egyptian, 25 per cent American, and the remainder Russian. The output is mainly fine sheetings, sateens, lawns, and a high quality of etamines. Wages are, on the whole, somewhat lower than in the mill previously described, being as follows: Scutcher tenders, 46 cents; card grinders, 42 cents; lap carriers, 37 cents; can tenders, 26 cents; comber operatives, 37 cents; drawing-frame hands, 38 cents; slubber, intermediate, and fine frame operatives, 47, 39, and 38 cents, respectively; ring spinners, 39 cents; mule spinners, 65 cents; spooler and winder hands, 36 cents; warper tenders, 46 cents; slasher tenders, 72 cents; weavers, 41 to 51 cents. In this mill the wages are lower than in the Morozoff mill, but the operatives in the latter appeared to be a better class of laborers, and the difference is more apparent than real.

The Voznesensky Manufacturing Co., at Pushkino, Moscow Government, is another first-class mill. It is managed by a young Englishman, who is an expert in all things pertaining to cotton manufacturing. There are 86,388 spindles and 1,510 looms, and 3,000 operatives are employed. The yarns spun are mainly 34s warp and 38s weft, and the production is exclusively print cloth. Power is produced by steam generated by wood fuel and by a gas engine. The latter is said to be one of the few gas engines successfully operated in Russian cotton mills. Undoubtedly it is one of the cheapest classes of power that can be employed, particularly in a country where coke is cheap and plentiful. The manager showed me the comparative costs, from actual tests, of the two kinds of power used. The figures were 58.95 rubles (\$30.36) per horsepower for the steam engine and only 21.91 rubles (\$11.28) per horsepower for the gas plant, for a year of approximately 4,500 hours.

Wages in this mill are at least 10 per cent lower than in the Koonshin Manufacturing Co.'s plant, which is doubtless due to the isolated location of the mill (it is 15 miles from the railroad) and the consequent lack of demand for labor outside the mill. In the weave room weavers were being paid 35.6 kopecks (18.3 cents) per piece (45½ yards) on 28-inch 74/70 print cloth made with 34s warp and 38s weft, with a loom speed of 225, and each weaver was tending two looms.

A list of the cotton mills in Russia, with number of spinning and twisting spindles and looms, which was prepared by the Moscow consulate general, will be found on pages 44-47.

COTTON-GOODS TRADE.

In 1909 Russia imported cotton yarn and cloth to the value of \$10,941,704, while the exports for the same year amounted to \$12,442,000. The detailed figures for 1910 (except those covering the trade by the European frontier) are not yet available. The course of the trade during the 20 years ended in 1909 is shown in the table following. The effect of the disturbances throughout Russia in 1905 and 1906 is revealed by the figures for those years.

Years.	Imports.				Exports.			
	Yarn.		Cloth.		Yarn.		Cloth.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1891....	5,909,570	\$2,506,000	2,133,510	\$678,000	(¹)	(¹)	(¹)	\$3,347,000
1899....	10,649,500	3,348,000	7,148,000	2,905,000	86,640	\$28,840	9,819,000	5,313,000
1905....	4,554,700	2,036,000	8,953,000	4,055,000	198,550	67,980	20,332,000	10,567,000
1906....	7,906,000	3,700,000	16,425,500	10,882,000	285,190	95,300	26,176,110	12,784,000
1907....	12,543,000	4,648,000	9,422,000	6,461,000	201,000	81,724	22,120,000	11,062,000
1908....	10,072,000	4,337,000	12,271,000	8,692,000	432,000	141,000	18,736,000	10,546,000
1909....	9,260,000	4,837,000	8,683,000	6,105,000	1,086,000	390,000	21,470,000	12,052,000

¹ Not available.

Imports and exports are both small in comparison with those of other leading European countries. The chief explanation for the almost insignificant imports, for they are insignificant in proportion to the size and population of the country, will be found in the customs duties (p. 8). The protection these rates afford to an industry which, as we have seen, is in a very high state of development is a strong check to the importation of cotton goods and has effectively secured the home market to the native manufacturers. The imports are limited to special kinds of yarn and cloth that are not used in sufficient quantities to make it advisable or profitable for the Russian mills to produce them. The market for what may be termed staple goods, those used by the masses of the people, is absolutely in the hands of the home industry, and the cotton manufactures imported are only special lines and those demanded by certain of the upper classes to whom the question of price is not very important.

NATURE OF THE IMPORTS.

The following detailed statement of the imports in 1909 gives an idea of the kind of goods purchased abroad:

Articles.	Quantity.	Value.
Yarn:		
Single—		
Below No. 38—	<i>Pounds.</i>	
Unbleached.....	1,107,728	\$218,984
Bleached, dyed, or mercerized.....	610,306	277,084
No. 38 to No. 60, inclusive—		
Unbleached.....	669,474	321,688
Bleached, dyed, or mercerized.....	50,142	24,980
No. 60 to No. 80, inclusive—		
Unbleached.....	291,038	143,194
Bleached, dyed, or mercerized.....	6,931	5,223
Above No. 80—		
Unbleached.....	130,898	119,738
Bleached, dyed, or mercerized.....	13,959	13,158
Twisted—		
On spools—		
Below No. 60.....	1,189,459	578,736
No. 60 to No. 80.....	1,138,641	654,746
Above No. 80.....	56,100	44,139
All other—		
Below No. 60.....	2,599,705	1,490,197
No. 60 to No. 80.....	875,930	451,632
Above No. 80.....	511,212	491,456
All other, including ropes and cords.....	9,169	1,950
Total.....	9,260,692	4,836,885
Fabrics:		
Unbleached or bleached—		
Blaz and mitkal (coarse calico) weighing up to 5.4 square yards per pound.....	2,718,005	635,511
Blaz and mitkal weighing from 5.4 to 8 square yards per pound and all other goods weighing up to 8 square yards per pound.....	2,079,901	1,444,016
Other fabrics weighing up to 8 square yards per pound.....	63,922	122,534
Dyed, printed, or mercerized—		
Blaz, mitkal, and chintz, weighing up to 5.4 square yards per pound.....	820,300	247,696
Blaz, mitkal, and chintz weighing from 5.4 to 8 square yards per pound and all other goods weighing up to 8 square yards per pound.....	1,929,111	1,512,436
Other fabrics weighing up to 8 square yards per pound.....	173,207	510,845
Felts and felted fabrics.....	15,739	8,880
Cotton fabrics mixed with silk or tinsel.....	21,443	50,861
Handkerchiefs, tablecloths, counterpanes, napkins, and curtains.....	172,341	361,617
Plush, velvet, and velvet ribbons.....	689,907	1,210,780
Total.....	8,683,876	6,104,816
Knit goods.....	894,402	1,263,685
Tulle.....	31,768	205,032
Laces and embroideries.....	226,744	2,069,246
Total.....	1,152,914	3,537,963
Grand total.....	19,097,482	14,479,694

FEATURES OF IMPORT TRADE.

These figures were compiled from customhouse statistics, and the classification is the same as that of the tariff. The items of knit goods, tulle, and laces and embroideries are misleading, because they represent all kinds except silk. Considering yarn and cloth only, the former constituted 44.2 per cent of the total imports. The chief yarns imported are special fancy and twist yarns, and ply yarn below No. 60 is the largest item in the list, followed by ply yarn on spools, which includes sewing thread. The native mills are gradually coming to supply all the requirements of the trade in the lower numbers and plain yarns and to restrict imports to the limits mentioned.

As showing the particular kinds of cotton cloth imported, the table is not very satisfactory. The goods are classed according to construction and weight, and each item includes a wide variety of both plain and fancy fabrics. Colored goods and plush and velvets constitute more than one-half the total cloth imports. Russian mills do not engage very extensively in the manufacture of fabrics made from dyed cotton or yarns and the chambrays, gingham, zephyrs, etc., found in the shops are nearly always from Germany, England, or France. Only fine velvets and plushes are imported, and more than 90 per cent of these come from Germany. In fact, Germany is the chief supplier of Russian needs, not only in cotton goods but in other lines.

According to Russian statistics the total imports into Russia in 1910 were valued at about \$490,000,000, of which Germany furnished \$227,000,000. These figures are to some extent misleading, however, because most of the goods imported into Russia from the United States and England, France, and other European countries go through Germany or are transshipped from German ports, in which case many of them are credited to that country rather than the country of origin. For example, the statistics show that imports from the United States amounted to only \$38,000,000 in 1910, whereas the American cotton used by the mills alone amounted to approximately \$50,000,000.

Nevertheless Germany's trade in Russia far exceeds that of any other country. Undoubtedly this is largely due to her nearness and the advantage of being able to keep in close touch with the trade and make quick deliveries. But German business methods, which have secured her an enormous trade in all parts of the world, have also contributed to success in Russia. Commercial travelers are sent to Russia in large numbers, small orders are accepted, and long credits are extended. In the cities of Moscow and St. Petersburg German is very generally spoken by the business men, and the buyers of the most important firms make frequent trips to Berlin.

SOURCE OF IMPORTS.

The share of the various nations in the imports of yarn and cloth in 1909 was as follows:

Countries.	Yarn.		Cloth.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Germany.....	2,827,171	\$1,892,717	1,861,757	\$3,322,429	4,688,928	\$5,215,146
England.....	4,648,813	2,397,826	295,117	486,429	4,943,930	2,884,255
China.....	7,581	1,618	3,808,517	952,278	3,816,098	953,896
Finland.....	896,601	183,354	1,625,655	637,992	2,524,256	821,346
Austria-Hungary.....	253,205	113,229	67,073	159,730	350,278	272,959
Japan.....	31,804	7,367	709,220	241,629	741,024	249,196
France.....	218,838	76,771	80,936	147,483	299,774	224,254
Switzerland.....	14,909	12,713	31,840	73,130	46,749	85,845
All other countries.....	359,770	151,290	173,701	83,516	533,531	234,806
Total.....	9,260,692	4,836,885	8,683,876	6,104,816	17,944,508	10,941,701

The comparatively large imports from Finland are due to the fact that low rates of duty are paid on cotton goods from that country.

Goods from China are admitted free along certain parts of the frontier, and large quantities of cheap fabrics are brought across the border and sold to people in Asiatic Russia. These are mostly cheap hand-woven products and include some goods from other countries sold through Chinese dealers.

DESTINATION OF EXPORTS.

Exports of cotton goods from Russia are also inconsiderable, and although they have more than doubled in the past 20 years the increase in recent times has not been important. In fact, Russian manufactures have found the demands of the home market so strong and profitable that they have not concerned themselves greatly about export trade. Only in the last year or two has much interest been manifested. This interest was aroused partly by the rather widespread crisis in the industry, which diminished the profits of the mills, and partly by the failure of the crops in 1911, which has curtailed the demand at home and prompted the manufacturers to seek foreign markets. An association has been recently organized among the manufacturers for the purpose of encouraging export trade in cotton goods.

The exports in 1909 are given in the following table:

Countries.	Yarn.		Cloth.		Total exports.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Persia.....	210,000	\$81,000	10,433,000	\$6,398,000	10,643,000	\$6,479,000
China.....	196,000	94,000	5,307,000	2,830,000	5,503,000	2,929,000
Afghanistan.....	28,000	13,000	2,527,000	1,584,000	2,555,000	1,597,000
Finland.....	3,000	500	1,806,000	525,000	1,808,000	525,500
Turkey.....	92,000	47,300	1,119,000	614,000	1,211,000	661,300
Roumania.....	1,000	600	87,000	43,000	88,000	43,600
Germany.....	556,000	153,000	31,000	15,000	587,000	168,000
All other countries.....	2,400	600	161,000	38,000	163,400	38,600
Total.....	1,086,000	390,000	21,470,000	12,062,000	22,536,000	12,442,000

RUSSO-PERSIAN TRADE—NATURE OF EXPORTS.

The exports of yarn are comparatively unimportant. Persia is Russia's best customer in cotton goods. Indeed, this is true in many lines. The total value of the imports into Persia in 1909 was approximately \$40,000,000, of which more than one-half came from Russia. Cotton goods constitute Persia's leading import, their value in 1909 being \$11,000,000, of which Russia furnished over 50 per cent. The Russian influence in Persia is very strong, particularly in the northern part of the country, where practically all business is in the hands of Russians, and this has secured to the Empire the bulk of the country's trade. Russian manufacturers are well informed as to the class of cotton goods in greatest demand, and they endeavor to cater to this demand and to the ever-changing styles. The goods shipped to Persia are gray and bleached sheetings, chiefly mitkal and biaz, and a great variety of cheap printed goods, including many grades of koomach and calico. Colored goods are in greatest demand in Persia, and they constitute 80 per cent of the total exports

thereto. The latter statement is also true with regard to Russia's two other principal markets, China and Afghanistan.

Russian statistics do not give in detail the classes of goods exported, but the following table shows the preponderance of colored goods in the total amount exported:

Classification.	Yarn.		Cloth.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Without drawback.....	402,000	\$119,500	3,941,000	\$1,274,500	4,342,000	\$1,394,000
With drawback:						
Bleached and unbleached....	544,000	191,000	3,336,000	1,762,500	3,880,000	1,953,000
Dyed or printed.....	118,000	67,500	9,266,000	5,735,000	9,385,000	5,803,000
Dyed Turkey red.....	22,000	12,000	4,927,000	3,280,000	4,949,000	3,292,000
Total.....	1,086,000	390,000	21,470,000	12,052,000	22,556,000	12,442,000

The goods exported without drawback include all those shipped to Finland and about one-third of the shipments to China, with which country Russia has a special tariff agreement. It may be safely assumed that most of these goods are printed, since such goods constitute the greater part of the manufactures. Exports to Persia and China have nearly doubled in the past 10 years. In Turkey, too, the manufacturers are obtaining an increasing amount of trade, and the shipments of cloth to that country amounted to 1,119,000 pounds in 1909, as compared with only 108,300 pounds in 1901. Recently agents have been sent into the Balkans, and in Roumania and Bulgaria a serious attempt is being made to capture a share of the cotton-goods trade.

It is evident that Russian cotton manufacturers will continue to concern themselves chiefly with their well-protected home market, but the growth of the industry is likely to be too rapid for the demands of the native population, and it is only natural that they should seek an outlet in the markets at their own door and in the countries in which they have already secured a foothold. But the Empire of the Czar is the most extensive on the globe, with the sole exception of Great Britain and its possessions, and it is practically a world within itself—a world, too, that is only beginning to develop its enormous resources. The improved condition of the people that must necessarily follow this development will increase the buying power of the peasants and create a larger demand at home for the products of the cotton manufacturing and other industries, and the protective principle, which appears to be a settled economic policy, will doubtless secure to the cotton industry the monopoly of the home market which it has hitherto enjoyed.

LIST OF RUSSIAN COTTON MILLS.

[In stating the locations of the mills the abbreviations "Gov." for Government and "Dist." for district are used. The Government is an administrative subdivision of the country corresponding to the State in this country. The Governments are divided into districts. The district as given under the heading "Location of mill." should not be confused with that in the first column, where the word is used in a general sense to indicate the different sections of Russia in which cotton manufacturing is carried on.]

Firm names and districts.	Location of mill.	Spinning spindles.	Twisting spindles.	Looms.
CENTRAL DISTRICT.				
Balashinsky Manufacturing Co. of Cotton Products.	Balashicha, Moscow Gov.	172,856	17,184	.....
A. J. Balin Manufacturing Co.	Jucha, Viaznikov Dist., Vladimir Gov.	128,748	6,380	1,790
Baranov Manufacturing Co.	Karabanovo, Alexandrovsk Dist., Vladimir Gov.	71,724	484	2,109
Bogorodsko-Glukhovo Manufacturing Co.	Glukhovo, near Bogorodsk, Moscow Gov.	126,328	26,180	3,358
Voznesensky Manufacturing Co., S. Lepeshkin's Sons.	Pushkino, Dmitrovsky Dist., Moscow Gov.	86,388	.....	1,510
Volga Spinning Manufacturing Co.	Near St. Volga, Mishkinsky Dist., Yaroslav Gov.	20,700	.....	.....
Voskresensky Manufacturing Co., of Emil Zündel Co.	Nara-Thominskoe, Ver. Dist., Moscow Gov.	112,816	.....	2,186
Viskovsky Manufacturing Co.	Nekrasino, Klin'sky Dist., Moscow Gov.	60,660	3,624	1,962
Nikon Garelin & Sons Co.	Ivanovo-Voznesensk, Vladimir Gov.	35,612	.....	859
Cotton Manufacturing Co., G. & A. Gorbunovs.	(1) Sereda, Nerechta Dist., Kostroma Gov.; (2) Ladigin near Kolobovo, Kovrov Dist., Vladimir Gov.	125,390	380	1,152
Staro-Gorkinsky Manufacturing Co.	Mikhnevo, Bronnitsky Dist., Moscow Gov.	21,000	100	728
Danilovsky Manufacturing Co.	Moscow City	59,248	920	1,160
Nikanor Derbenef's Sons Manufacturing Co.	(1) Novki (Nizhegor Ry.); (2) Ivanovo-Voznesensk, Vladimir Gov.	84,000	.....	2,122
Dneprovosky Manufacturing Co. (Ltd.)	Dubrovno, Mohilev Gov.	.....	1,200	360
Egorievsky Cotton Manufacturing Co., A. & G. Khludov.	Egorievsk, Ryazan Gov.	177,816	7,488	1,740
Ermolaev Bros. Manufacturing Co.	Near Serpukhov, Moscow Gov.	4,000	.....	82
Zuev Manufacturing Co., I. N. Zimin.	St. Drezna, Moscow Gov.	98,072	1,600	2,269
Ivanovo-Voznesensk Weaving Co.	Ivanovo-Voznesensk, Vladimir Gov.	69,608	.....	2,205
Izmallov Cotton Manufacturing Co.	Izmallovo, Moscow Gov.	27,000	.....	620
Alexander Karetnikov's Sons' Manufacturing Co.	Teikovo, Vladimir Gov.	68,026	.....	1,902
Ivan Kononov & Son Manufacturing Co.	Boniatshki, Kineshma Dist., Kostroma Gov.	72,796	5,312	2,237
Annensky Manufacturing Co., Ivan Kapitonovitch Kononov.	Near Kineshama, Kostroma Gov.	34,030	.....	572
N. N. Konshin Manufacturing Co.	Serpukhov, Moscow Gov.	115,000	2,184	4,100
Gratry, Gerard & Michin, Société Anonyme.	Kostroma	50,000	10,624	.....
Anna Krasishikova & Sons Manufacturing Co.	Rodniki, Kostroma Gov.	84,652	2,784	3,009
Krestovnikov Bros.	Polano, Moscow Gov.	76,612	3,924	.....
Lajnevsky Manufacturing Co.	Lajnevo, Vladimir Gov.	28,000	.....	800
Commercial and Industrial Co., P. Malutin & Sons.	Near Ramenskoe (Moscow-Kazan Ry.), Moscow Gov.	158,034	5,936	1,770
Vasil Morgunov's Sons Manufacturing Co.	Ozeri, Moscow Gov.	27,400	.....	1,017
Vikul Morozoff & Sons Manufacturing Co.	Zuevo, Vladimir Gov.	155,456	17,970	2,503
A. F. Morokin.	Nova Galehcha (Northern Ry.), Kostroma Gov.	16,112	900	814
J. S. Netchaev-Maltzev.	Gosk-Khrustalni, Vladimir Gov.	104,668	.....	1,636
Nikolsky Manufacturing Co., Savva Morozoff's Son & Co.	Nikolskoe, near Orekhovo, Vladimir Gov.	170,488	.....	3,875
Nikolsko-Borogavlensky Manufacturing Co., D. Morokin, I. Tichomirov & Co.	St. New Vitschuga, Kostroma Gov. New Goltchicha, Morokina and Tichomirova.	25,000	300	1,045
Nora Manufacturing Co.	Norski Posad, Yaroslav Gov.	100,000	.....	.....
Pereslavl Manufacturing Co.	Pereslavl Zaleski, Vladimir Gov.	115,518	9,184	.....

List of Russian cotton mills—Continued.

Firm names and districts.	Location of mill.	Spinning spindles.	Twisting spindles.	Looms.
CENTRAL DISTRICT—continued.				
Pokrovsky Cotton & Weaving Manufacturing Co.	Jacroma Station, Dmitrov Dist., Moscow Gov.	110,218	2,016	2,150
N. M. Polushin Heirs Manufacturing Co.	Ivanovo-Voznesensk, Vladimir Gov.	12,000	600	1,200
Kosma Prochorov & Sons Manufacturing Co.	(1) Vishny Volotchek, Tver Gov.; (2) St. Podsolnetchnaia, Moscow Gov.	93,000	.....	1,537 763
Prochorov Trechgori Manufacturing Co.	Moscow City.....	41,188	644	1,627
Ludwig Rabeneck Manufacturing Co.	Near Tselkovo Station (Northern Ry.).	38,000	2,080	832
Frans Rabeneck Manufacturing Co.	Bolshevo (Northern Ry.), Moscow Gov.	34,440	12,300	.....
Vitchugsky Manufacturing Co., F. & A. Razorenov.	Vitchuga (Northern Ry.), Kostroma Gov.	67,144	.....	1,760
Gerasim Razorenov & Ivan Kokorev Manufacturing Co.	Tezino, Kostroma Gov.....	100,296	.....	2,501
Grand Kineshma Manufacturing Co.	Kineshma, Kostroma Gov.....	59,628	712	1,175
Reutovo Manufacturing Co.....	Reutovo, Moscow Gov.....	76,728	16,954	.....
Roshdestvensky Manufacturing Co., Berg Bros.	Tver City.....	90,520	.....	2,412
Russian-French Cotton Manufacturing Co., Société Anonyme.	Pavlovsky Posad, Moscow Gov.....	65,700	.....	1,632
Riabov Cotton Manufacturing Co...	Serpukhov, Moscow Gov.....	48,892	496	1,718
P. M. Riabushinsky & Sons Manufacturing Co.	Zavorovo, Vishnevolotsky Dist., Tver Gov.	69,024	11,936	1,233
Savvinsky Manufacturing Co.....	Obralovka, Moscow Gov.....	29,000	.....	418
Sedkov Manufacturing Co., Ivan Demin.	Sadki, Kolomna Dist., Moscow Gov.	30,524	.....	1,002
P. F. Sverugov Heirs.	Kineshma, Kostroma Gov.....	67,312	366	1,575
Serpukhov Cotton Weaving Co. (Ltd.)	Serpukhov, Moscow Gov.....	42,432	.....	.....
Manufacturing Co. founded by I. I. Skvortsov.	Sereda Station, Kostroma Gov.....	70,324	.....	3,466
A. & K. Slutchaev.....	Kellerovo, Vladimir Gov.....	10,000	.....	.....
A. V. Smirnov.....	Likino, Vladimir Gov.....	48,500	.....	1,332
Bobinsky Manufacturing Co.....	St. Undol, Vladimir Gov.....	132,000	2,800	204
Asaf Baranov's Sokolovsky Manufacturing Co.	St. Strunino, Alexandrovsk Dist., Vladimir Gov.	50,000	600	1,400
Tver Manufacturing Co. of Cotton Products.	Tver City.....	154,700	.....	3,970
Moscow Textile Manufacturing Co.	Serpukhov, Moscow Gov.....	64,576	4,308	695
I. A. Treumov Heirs.....	Kovrov, Vladimir Gov.....	36,000	.....	2,002
Société Anonyme of Zurich for Russian Cotton Industry.	Zaraisk, Ryazan Gov.....	57,140	3,376	.....
Pelageta Tchernishova's Sons Broadcloth Manufacturing Co.	Pirogovo, Moscow Gov.....	17,560	984	70
Istominsky Manufacturing Co., E. K. Shibaev Heirs.	Istomkino, near Bogorodsk, Moscow Gov.	55,024	380	1,250
E. E. Shlichterman.....	(1) Moscow City; (2) Isupovo, Podolsk Dist., Moscow Gov.	41,230	.....	.....
Shnia Manufacturing Co.....	Shuia, Vladimir Gov.....	53,300	.....	1,222
Shuia-Tezino Manufacturing Co.....	do.....	27,984	.....	379
Theodore Scherbakov & Sons Manufacturing Co.	Ozeri, Kolomna Dist., Moscow Gov..	66,750	520	1,748
Great Yaroslav Manufacturing Co...	Yaroslav.....	261,866	11,266	1,912
Yartsev Manufacturing Co.....	Yartzevo, Smolensk Gov.....	138,218	5,528	1,645
V. E. & A. Jasuninski Manufacturing Co.	Kochma, Yaroslav Gov.....	60,056	1,408	1,232
BALTIC DISTRICT.				
Baltic Cotton & Weaving Manufacturing Co. (Ltd.).	Reval.....	66,744	.....	1,775
James Back Cotton Manufacturing Co. (Ltd.).	St. Petersburg.....	105,576	21,390	.....
I. A. Voronin, Lutsch & Teschesher Manufacturing Co. (Ltd.).	do.....	66,652	1,416	1,790
William Hartley.....	do.....	.....	7,000	40
K. V. Gerardi Cotton Manufacturing Co. (Ltd.).	do.....	23,500	3,000	.....
Ekaterinhof Cotton Manufacturing Co.	do.....	140,130	.....	.....
Sassenhof Cotton & Weaving Manufacturing Co.	Sassenhof, near Riga.....	26,064	4,228	465
Krenholm Manufacturing Co.....	Narva, St. Petersburg Gov.....	472,500	13,800	3,672
Malo-Okhta Weaving Manufacturing Co.	St. Petersburg.....	.....	2,744	320
Neva Cotton Manufacturing Co.....	do.....	132,000	100,000	.....

List of Russian cotton mills—Continued.

Firm names and districts.	Location of mill.	Spinning spindles.	Twisting spindles.	Looms.
BALTIC DISTRICT—continued.				
Neva Cotton Weaving Manufactur- ing Co.	St. Petersburg.....	221,460	51,212	.....
"New Cotton Weaving Mill" Co....	do.....	100,000	.....	.....
Okhta Cotton Weaving Co.....	do.....	73,262	2,008	.....
Alexandro-Nevsky Manufacturing Co., K. J. Pal.	do.....	22,000	.....	1,384
Petrovsky Cotton & Weaving Co....	Smolenskoe, St. Petersburg Gov....	48,816	1,200	1,500
Riga Cotton & Ribbon Manufac- turing Co.	Riga.....	15,332	6,122	260
Riga Cotton Manufacturing Co. in Strazdenhof.	Strazdenhof, near Riga.....	14,600	22,286	.....
Russian Cotton Weaving Manufac- turing Co.	St. Petersburg.....	121,500	.....	.....
Henry Small.....	do.....	16,000	.....	.....
Spassky Cotton Weaving Manufac- turing Co.	Smolenskoe, St. Petersburg Gov....	44,122	.....	1,288
Sampson Cotton & Weaving Manu- facturing Co.	St. Petersburg.....	62,412	1,256	1,477
Northern Weaving Manufacturing Co. (Ltd.).	do.....	.....	5,064	367
Triumphal Weaving & Cotton Manufacturing Co.	do.....	30,866	816	.....
WESTERN DISTRICT.				
Henry F. Berndt.....	Zavertse (Warsaw-Vienna Ry.).....	8,000	.....	.....
R. Biderman.....	Lodz.....	35,000	7,700	440
Cotton Manufacturing Co. "Volla," E. Helman & M. Kernbaum.	Volla, near Warsaw.....	29,372	9,576	200
Cotton Manufacturing Co., Gampe & Albrecht.	Lodz.....	11,000	.....	545
Cotton & Rubber Manufacturing Co., Ferdinand Geldner (Ltd.).	do.....	8,500	.....	.....
Louis Heyer Cotton Manufactur- ing Co.	do.....	46,514	848	1,578
Heintzel & Kuntzer Cotton Manu- facturing Co. (Ltd.).	do.....	56,920	1,394	2,713
J. Hirschberg & Wiltchinsky.....	do.....	3,400	.....	.....
Karl Hoffrichter.....	do.....	6,720	.....	362
G. Groman.....	do.....	30,000	10,000	.....
L. Groman Manufacturing Co. (Ltd.).	do.....	5,176	.....	1,136
Gille & Dietrich Girardov Manu- facturing Co. (Ltd.).	Girardov (Warsaw-Vienna Ry.).....	35,000	.....	2,000
Zavertse Co. (Ltd.).	Zavertse, Bendij Dist., Piotrkow Gov.	79,276	3,350	2,602
M. Silberstein Co. (Ltd.).	Lodz.....	23,600	2,680	.....
Zerge Cotton Manufacturing Co. (Ltd.).	Zerge, Piotrkow Gov.....	25,156	6,846	.....
J. Kistenberg.....	Lodz.....	22,200	1,100	280
R. Kindler Half-wool Manufactur- ing Co. (Ltd.).	Pabianitz, Piotrkow Gov.....	12,300	.....	1,043
K. Krenig.....	Lodz-Karolev.....	14,184	2,800	120
Krushe & Ender Pabianitz Cotton Manufacturing Co.	Pabianitz, Piotrkow Gov.....	47,602	3,396	1,848
Kuester Bros.....	Zerge, Piotrkow Gov.....	5,000	300	.....
Lodz Cotton Manufacturing Co. (Ltd.).	Lodz.....	41,896	18,096	.....
Lorentz & Krushe Cotton Manu- facturing Co. (Ltd.).	Zerge, Piotrkow Gov.....	3,500	.....	155
Lorentz & Krushe Cotton Manu- facturing Co. (Ltd.).	do.....	15,000	4,132	.....
M. Lubinsky.....	Lodz.....	4,000	.....	60
Adam Osser.....	do.....	30,092	11,236	.....
I. K. Poznansky Cotton Manufac- turing Co. (Ltd.).	do.....	136,466	672	4,353
F. Ramish.....	do.....	10,000	.....	342
E. Ramish.....	do.....	13,000	2,500	.....
Sh. Rosenblatt Cotton Manufac- turing Co. (Ltd.).	do.....	58,096	6,840	719
Russian Commercial & Industrial Co., Emile Hebler.	Lodz and Dombrova.....	20,378	5,304	.....
V. V. Stolarov.....	Lodz.....	11,000	5,400	465
Tchenstokhov Weaving Co. (Ltd.).	Tchenstokhov, Piotrkow Gov.....	50,100	6,400	485
Karl Shebler Cotton Manufactur- ing Co. (Ltd.).	Lodz.....	222,574	12,250	4,848
K. G. Shoen.....	Sosnovitz, Piotrkow Gov.....	19,500	.....	.....
Schloesser Cotton & Weaving Co....	Ozerkov, Kalisz Gov.....	19,090	.....	693
August Schmeltzer Cotton Manu- facturing Co.	Mishkov, Bendinsky Dist., Piotrkow Gov.	25,000	.....	.....

List of Russian cotton mills—Continued.

Firm names and districts.	Location of mill.	Spinning spindles.	Twisting spindles.	Looms.
WESTERN DISTRICT—continued.				
Gustave Schroer.....	Lodz.....		8,200	.....
Steigert Bros.....	do.....	6,000	1,400	.....
F. Steigert.....	do.....	20,000	4,000	.....
Karl Steinert.....	do.....	17,168	400	500
F. Ender.....	Mosbennitsa, near Baba Station (Warsaw-Vienna Ry.), Piotrkow Gov.	13,096	.....	620
OTHER DISTRICTS.				
Caspian Manufacturing Co.....	Near Petrovsk, Daghestan.....	17,728	320	573
Saratov Manufacturing Co.....	Khmelevka, Saratov Gov.....	38,240	10,440	.....
Hadgi Zeinal Abidin Tagiev, Cau- casian Co. for Cultivating Fibre Products.	Baku.....	36,876	588	1,215
FINLAND.				
John Barker & Co.....	Abo.....	21,252	2,952	660
Bierneborgs Bomullsmanufaktur Aktiebolag.	Bierneborg.....	20,000	5,000	500
Vasa Bomullsmanufaktur Aktie- bolag.	Vasa.....	28,290	12,514	652
Tampereen, Puuvillateollisuus, Osakeittie.	Tammerforce.....	23,104	6,604	470
Finleison & Co., Aktiebolag.....	do.....	90,000	12,500	1,820
Forssa Aktiebolag.....	Forssa.....	40,200	7,396	1,049

LIST OF SAMPLES.

Sample 1.—Mitkal, or coarse sheeting; 26/27 inches wide; 48 by 48 picks; retail price, 10 kopecks per arshine (6.6 cents per yard).

Sample 2.—Mitkal, better quality; 26/27 inches wide; 60 by 56 picks; retail price, 12 kopecks per arshine (7.9 cents per yard).

Sample 3.—Mitkal, bleached; 25/26 inches wide; 60 by 56 picks; retail price, 14 kopecks per arshine (9.3 cents per yard).

Sample 4.—Biaz, a little better grade of sheeting than the above; 27/28 inches wide; 56 by 56 picks; retail price, 17 kopecks per arshine (11.3 cents per yard).

Sample 5.—Biaz, bleached; 24/25 inches wide; 60 by 44 picks; retail price, 16 kopecks per arshine (10.6 cents per yard).

Sample 6.—Biaz, bleached; 27/28 inches wide; 56 by 48 picks; retail price, 18 kopecks per arshine (11.9 cents per yard).

Sample 7.—Koomach, red; 24 inches wide; 96 by 72 picks; retail price, 20 kopecks per arshine (13.24 cents per yard).

Sample 8.—Koomach, blue; 24 inches wide; 96 by 72 picks; retail price, 18 kopecks per arshine (11.9 cents per yard).

Sample 9.—Koomach, indigo; 24 inches wide; 96 by 72 picks; retail price, 17 kopecks per arshine (11.3 cents per yard).

Sample 10.—Chintz; 25 inches wide; 80 by 56 picks; retail price, 20 kopecks per arshine (13.24 cents per yard).

Sample 11.—Chintz; 25 inches wide; 80 by 56 picks; retail price, 18 kopecks per arshine (11.9 cents per yard).

Sample 12.—Chintz; 24 inches wide; 56 by 56 picks; retail price, 12 kopecks per arshine (7.9 cents per yard).

Sample 13.—Boomazey; 23/24 inches wide; 72 by 44 picks; retail price, 14 kopecks per arshine (9.3 cents per yard).

Sample 14.—Boomazey; 22 inches wide; 72 by 44 picks; retail price, 17 kopecks per arshine (11.3 cents per yard).

Sample 15.—Boomazey; 24 inches wide; 64 by 56 picks; retail price, 24 kopecks per arshine (15.9 cents per yard).

DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 52

UTILIZATION OF ATMOSPHERIC NITROGEN

By

THOMAS H. NORTON

Consul at Chemnitz, Germany, on detail as Commercial Agent
of the Department of Commerce and Labor

TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD



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LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE AND LABOR,
Washington, August 15, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ended June 30, 1912, approved March 4, 1911, a report by Commercial Agent Thomas H. Norton, of this department, containing the results of his investigations of the utilization of atmospheric nitrogen.

Respectfully,

BENJ. S. CABLE,
Acting Secretary.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, April 3, 1912.

SIR: I have the honor to submit herewith a report on the air-nitrate industry by Consul Thomas H. Norton, of Chemnitz, who is on special detail for the Department of Commerce and Labor for the investigation of the chemical industries of Europe. For many years the world has been dependent on the nitrate beds of Chile for supplies of combined nitrogen, and as these beds are not inexhaustible and as the demand for combined nitrogen by manufacturing and agricultural interests is rapidly increasing, serious efforts have been made to discover new deposits, and many prominent chemists have endeavored to perfect processes for utilizing atmospheric nitrogen. The report deals with the present supply of nitrogen, the synthetic production of ammonia, the synthesis of nitric acid, hydrocyanic acid, cyanides, nitrides, and calcium cyanamide from atmospheric nitrogen, and coal waste and peat as sources of ammonia. It should be of value in view of the fact that the United States now spends over \$32,000,000 abroad for nitrogen in its various combinations.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

To Hon. CHARLES NAGEL,
Secretary of Commerce and Labor.

UTILIZATION OF ATMOSPHERIC NITROGEN.

INTRODUCTION.

One of the chief services rendered by chemistry during the nineteenth century was to reveal the dependence of animal and vegetable life upon nitrogen, to define clearly the rôle of this element in nature, and to increase the number of technical products containing nitrogen.

At the close of the century the consumption of such compounds had reached an enormous figure and was growing at a steadily increasing rate. At the same time economists saw clearly that the sources were limited, that their value would soon mount, and that at no distant date it would be impossible to supply the world's demand for combined nitrogen.

The recognition of these facts has led to the intense study of the best means of increasing the supply of nitrogenous compounds, one of the pressing economic problems of the twentieth century. Its importance is felt most keenly in Germany, where the annual per capita consumption of nitrogen in the form of crude primary compounds has now reached 5.18 pounds.

In the United States the per capita consumption is at present only a little over half that for Germany. It is, however, rapidly growing, and the annual sum now sent abroad for the purchase of nitrogenous compounds has become an important item. In 1910 the imports into the United States were as follows:

Compounds.	Value.	Compounds.	Value.
SIMPLE COMPOUNDS.		MORE VALUABLE COMPOUNDS—contd.	
Ammonium salts, chiefly sulphate.....	\$3,771,010	Collodion, pyroxylin, celluloid.....	\$333,975
Calcium cyanamide.....	40,091	Explosives.....	1,002,961
Guano.....	819,879	Indigo.....	1,223,975
Sodium nitrate (Chile saltpeter).....	16,548,036	Lead nitrate.....	6,754
MORE VALUABLE COMPOUNDS.		Picric acid.....	15,629
Anilin oil and salts.....	714,657	Potassium nitrate.....	791,222
Coal-tar dyes.....	6,016,033	Potassium prussiate.....	242,367
Coal-tar derivatives (medicinal, etc.), estimated.....	800,000	Saccharin.....	5,526
		Sodium nitrate.....	52,237
		Total.....	32,384,352

The actual consumption of nitrogen in its cruder forms in the United States in 1910 was as follows:

Combination.	Weight.	Nitrogen contained.
	<i>Long tons.</i>	<i>Pounds.</i>
Ammonium sulphate, imported.....	58, 409	25, 903, 000
Ammonium sulphate, domestic.....	120, 454	55, 317, 000
Calcium cyanamide, imported.....	764	343, 000
Guano, imported.....	46, 819	13, 634, 000
Sodium nitrate.....	542, 334	188, 300, 000
Total.....	766, 790	283, 496, 000

As shown in the first table, the United States is now sending abroad over \$32,000,000 annually for the purchase of nitrogen in its various combinations, and over half of this sum is expended for a single item and goes to a single country—Chile. Further, nearly all of the nitrogen contained in the list of more valuable nitrogenous compounds is derived from Chile saltpeter exported to European countries, chiefly Germany.

The fact that the United States, in common with all civilized countries, and especially with all manufacturing countries, is so dependent upon this one source, and the additional fact that the deposits of nitrate in Chile are not particularly extensive and are destined at an early date to complete exhaustion, constitute the nitrogen problem.

The efforts that are being made to release the manufacturing and agricultural interests of the world from this dependence assume an increasing importance each day. The most decided progress is being made by the chemists in Germany, Scandinavia, France, Switzerland, and Austria. An attempt has been made in this monograph to show the full extent of the problem, especially in its bearing upon American industrial and economic interests, and to furnish as accurate and comprehensive data as possible of the results thus far obtained by European chemists in their efforts to increase the supply of nitrogen.

I am indebted to the leading workers in this field in France, Germany, and Scandinavia for very full information, personally and by letter, and for the opportunity to visit the extensive works now in operation for the utilization of atmospheric nitrogen.

THE PRESENT SUPPLY OF NITROGEN.

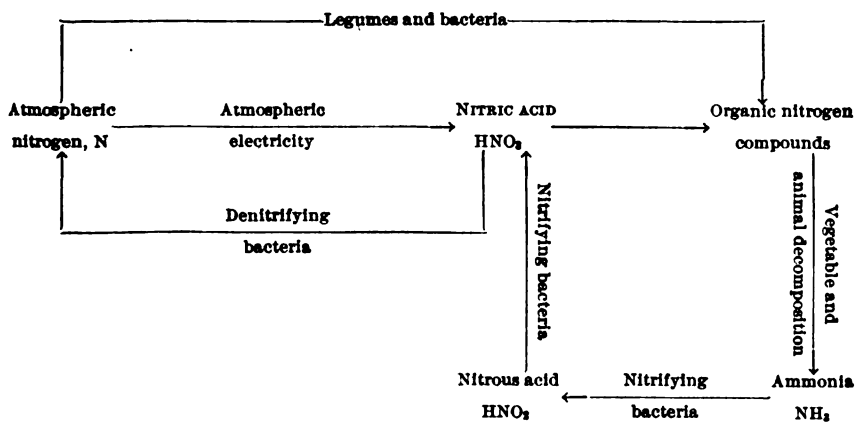
NITROGEN IN NATURE.

The nitrogen problem of the day is almost unique in one respect—the material is abundant, in fact it is unlimited. The difficulty is to bring it into form available for the wants of mankind.

The atmosphere enveloping the globe consists chiefly of nitrogen, which constitutes 78 per cent of its volume and 75.5 per cent of its weight. It has been estimated that the column of air resting upon each square yard of the earth's surface contains 5.8 tons¹ of nitrogen in the free elementary state. Recent investigations show that the rock forming the solid crust of the globe contains a measurable amount of combined nitrogen—about 350 grams per cubic meter. Assuming a thickness of 10 miles for the crust, this represents a weight of about 4.5 tons of nitrogen beneath each square yard of surface. The atmospheric nitrogen above 1 square mile of land, amounting to about 20,000,000 tons, is equivalent to what the world would require in the next 50 years at the present rate of consumption.

Of this enormous reserve, a minute fraction, about 0.000002, is in the active service of the vegetable and animal kingdoms. In the soil, in the form of nitrate, it is a chief factor of plant food. With the plants it passes into the bodies of animals, whence it returns to the soil. Through the action of bacteria a small portion reverts to the elementary form of atmospheric nitrogen. Through the action of other bacteria, with the aid of certain legumes, and by electric discharges in the air, a corresponding amount is constantly brought into a combined form and enters the cycle of changes. The amount of this "nomadic" nitrogen, as it has aptly been termed, is on an average about 20 grams for each square yard of land.

These transformations are ingeniously shown by Prof. P. H. Guye in the following diagram:



¹ The metric ton of 2,204.6 pounds is used throughout the monograph unless otherwise noted.

As the result of electric action in the air about 100,000,000 tons of combined nitrogen are restored annually by nature to the soil of our planet, present in the form of nitric acid and nitrates in descending rain. At points distant from inhabited places, especially on the sea-coast, experiments show that a cubic meter (35.314 cubic feet) of earth contains on an average 0.3 to 0.4 gram of nitric acid. The amount returned to the soil in this manner each year averages but a few tenths of a gram of nitrogen per square yard. Were it possible to rescue 1 per cent of the vast mass of newly formed nitric acid thus contributed from the clouds, the nitrogen question would be settled for generations to come.

INCREASED DEMAND FOR COMBINED NITROGEN.

In a state of nature, and until recent years, the conditions of equilibrium, as typified by the foregoing diagram, were fairly constant. Toward the middle of the nineteenth century a disturbing force came into play as the result of the increase of population in those countries where cereal foods are a staple element of diet, more particularly in Europe and North America. The methods provided by nature for maintaining a certain normal degree of fertility were no longer adequate in order to insure a sufficient supply of wheat and other cereals in various countries. In order to increase the yield on a given area of land, recourse was had to artificial fertilizers. The needed nitrogen was obtained partly from the ammonia secured as a by-product in the manufacture of gas, to some extent from accumulated deposits of guano, and largely from the remarkable deposits of sodium nitrate in the arid region of northern Chile. For over half a century the consumption of both ammonium compounds and sodium nitrate has increased constantly. In addition to the demands of agriculture, modern chemical industry calls for vast amounts of nitric acid and its derivatives. One-fifth of the Chile saltpeter now consumed in Europe goes into the manufacture of explosives, of coal-tar colors, and of other allied products.

When Sir William Crookes sounded a note of alarm in 1898 as to the possibility of nourishing the prospective millions of America and Europe toward the close of the present century, he based his calculations chiefly on the limited area of land suitable for the profitable cultivation of cereals. He estimated that the bread eaters numbered 516,000,000 in 1898, and were increasing at the rate of 6,000,000 annually. The acreage of cereals was 167,000,000 in 1898, and only 100,000,000 acres more were available for such culture. The annual per capita consumption of wheat was 4.6 bushels, and the average yield per acre 12.8 bushels. On this data he calculated that by 1941 the wheat fields of the world must cover 292,000,000 acres in order to meet the demands of a prospective population of 819,000,000 bread eaters.

In this connection it is shown that with an adequate supply of nitrogen as fertilizer it will easily be possible, by the methods of intensive agriculture, so to increase the yield of cereals per acre that the danger line can be advanced far into the next century. Even in 1898 the sandy soil of Denmark was producing 42 bushels of wheat per acre as a result of modern intensive culture.

EUROPEAN EXPERIMENTS WITH FERTILIZERS.

Prof. H. Erdmann has recently collated in a valuable form data from German experiments with fertilizers to show how easily the productivity of farms of the Empire may be increased. His table follows:

Crops.	Present acreage.	Average crop per acre.	Possible crop by intensive culture.	Nitrogen to add per acre.	Additional crop obtained.	Present German imports.
		<i>Tons.</i>	<i>Tons.</i>	<i>Pounds.</i>	<i>Tons.</i>	<i>Tons.</i>
Rye.....	15,000,000	0.60	1.20	52.8	9,000,000	572,000
Wheat.....	6,000,000	.75	1.60	114.4	4,800,000	2,287,000
Oats.....	10,000,000	.69	1.52	88.0	8,000,000	966,000
Potatoes.....	8,000,000	5.20	12.00	106.6	40,000,000	350,000
Barley.....	2,500,000	.66	1.40	52.8	1,500,000	1,620,000
Total.....	41,500,000				63,300,000	5,795,000

These proposed additions of nitrogen are naturally supplementary to the quantities already employed in German agriculture, on an average 50 pounds per acre. It is also to be understood that any increase in the application of nitrogenous fertilizers to the soil is accompanied by a corresponding increase in the relative amounts of potash salts and phosphoric acid, equally necessary as constituents of the normal plant. Fortunately, the available supplies of potash salts and of phosphates are such that no shortage of either is to be feared, although in the case of potash the world is largely dependent upon the deposits in a single country—Germany.

As illustrating the correctness of the figures advanced by Prof. Erdmann, the following table is added to show the rôle actually played by nitrogen in the cereal production of Europe—the figures are the averages for the crops of 1903–1907:

Countries.	Wheat.	Rye.	Barley.	Oats.	Nitrogen applied per acre.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Pounds.</i>
Germany.....	0.848	0.652	0.760	1.880	50.0
Austria.....	.492	.500	.548	.400	26.0
Hungary.....	.480	.460	.504	.452	24.0
France.....	.584	.456	1.000	1.000	31.0
Belgium.....	1.040	.720		2.464	58.0
Portugal.....	.300				3.5
Italy.....	.352	.360		.328	

AVAILABLE SOURCES OF COMBINED NITROGEN.

The necessity of a liberal use of nitrogenous fertilizers will soon be imperative throughout all sections of the United States as the population increases and suitable land for agricultural purposes is no longer available. Under these circumstances it is desirable to establish an inventory of the available stores and sources of nitrogen in a combined form apart from the industrial products. They may be classified as follows:

Matter of vegetable origin.—Vegetable refuse; nitrogen compounds in the humus of the soil; the waste of sugar works and distilleries.

Matter of animal origin.—Animal manures; fish meal; slaughterhouse refuse, pondrette, etc.; material of a durable nature, such as hair, leather, wool, silk, hoofs, horns, guano, and coprolites.

Coal and lignite.

Peat and silt.

Mineral deposits.—Saltpeter, KNO_3 ; Chile saltpeter, NaNO_3 .

Combined nitrogen in rocks.

The substances enumerated under matter of vegetable and animal origin are all nitrogenous matters that fall into the cycle of changes shown in Prof. Guye's diagram, page 11. They are either complicated organic substances, ready to undergo decomposition, or such as have undergone partial decomposition. All are available as plant food. An important problem of modern agriculture is involved in the maximum utilization of nitrogen in these forms. Nitrogen once rescued from its inert elementary form in the atmosphere and brought into combination with other elements must be kept as far as possible within the simple circle of serving as plant food, next as animal food, and then of returning to the soil as plant food. There is little doubt that the artificial conditions of modern life involve a much greater loss of nitrogen in the combined form than is the rule in a state of nature.

Special note is to be made of the animal matters of a durable nature. They are less liable to decomposition than the class just dealt with. Many of these substances, however, especially horn, hoofs, leather, and woollen rags, are used as raw material for the manufacture of cyanides, an industry in which unfortunately the greater portion of the nitrogen present is not utilized, but reverts to elementary forms.

THE GUANO INDUSTRY.

Guano is as highly valued for use as a fertilizer on account of the phosphoric acid present as on account of the 12 to 14 per cent of nitrogen which it contains. The chief sources are confined to various islands and precipitous coasts of tropical and semitropical Africa, America, and Oceania. Patagonia and Labrador also furnish a supply. These accumulated deposits of the excrement of birds are being so steadily diminished that before many years they will cease to be a factor in the nitrogen supply. The Peruvian Government has, however, taken measures to protect bird life on its islands and insure to some extent the continuance of its guano supply. The Peruvian production now amounts to less than 100,000 tons annually, of which about 60,000 tons are exported. The exports from Peru have exceeded 11,000,000 tons during the past 70 years. Occasionally a valuable new deposit is discovered, such as the extensive supply on an island opposite Campeche, Mexico. It is estimated that 10,000,000 tons are available on the island, and an American company has secured the concession for 10 years.

During 1910 the United States imported 46,819 long tons of guano, valued at \$819,879, averaging \$17.51 per ton. These imports have steadily increased of late years. They were 18,000 tons in 1906. Germany imported 33,000 tons during 1910. The average import since 1892 has been 47,000 tons.

NITROGEN IN COAL.

The most important reserve stock of nitrogen on the planet is found in the widespread deposits of coal, the fossil remains of the vegeta-

tion of former geological periods. The nitrogen present in coal is as follows: Anthracite contains 0.1 to 0.5 per cent; bituminous coal, 0.5 to 1.5 per cent; and lignite, or brown coal, 1 to 2 per cent.

When coal is exposed to dry distillation, as in gas manufacture or in the operation of coking, a part of the nitrogen is given off in the form of ammonia (accompanied by small amounts of hydrocyanic acid, pyridine, and more complex nitrogenous compounds), another part escapes as free nitrogen, and the rest remains in the residual coke and returns in its elementary form to the air when the coke is burned. One-eighth to one-fifth of the nitrogen originally imprisoned in the coal is obtained in the form of ammonia and the remainder escapes as inert elementary nitrogen. On the average, 100 pounds of bituminous coal, on distillation or coking, yield 0.275 pound of ammonia, corresponding to 1.07 pounds of pure ammonium sulphate and 0.227 pound of nitrogen.

The greater amount of the coal regularly mined is bituminous. One-fifth of the annual American supply, however, is anthracite; and two-thirds of Austria's supply and nearly one-third of Germany's consists of lignite.

In 1909 the total amount of coal mined in the whole world was estimated at 1,010,000,000 tons. The distribution was as follows: United States, 397,000,000 tons; Great Britain, 268,000,000 tons; Germany, 217,000,000 tons; Austria-Hungary, 42,000,000 tons; France, 38,000,000 tons; Belgium, 24,000,000 tons; Russia, 24,000,000 tons. The consumption in 1875 was 290,000,000 tons.

THE MANUFACTURE OF AMMONIUM SULPHATE.

If all the coal mined were distilled or coked prior to use as fuel it would yield about 11,800,000 tons of pure ammonium sulphate, or 2,500,000 tons of nitrogen in the combined form. Were all the nitrogen present in the annual coal output rescued in a combined form it would mean a yield to-day of at least 50,000,000 tons of pure ammonium sulphate, or 11,000,000 tons of nitrogen. The actual amount of commercial ammonium sulphate secured from coal was only 2,000 tons in 1860. It amounted, in 1900, to 450,000 tons; in 1909, to 950,000 tons. In 1910 it had increased to 1,100,000 tons, equivalent to about 225,000 tons of nitrogen. The chief producing countries were:

Countries.	Quantity.	Countries.	Quantity.
	<i>Tons.</i>		<i>Tons.</i>
Germany.....	383,000	Spain.....	12,000
Great Britain.....	369,000	Italy.....	12,000
United States.....	116,000	Holland.....	5,000
Austria-Hungary.....	70,000	Japan.....	4,000
France.....	57,000	Other countries.....	36,000
Belgium.....	36,000		

In Germany the annual production of sulphate has now reached the point at which the domestic demand is met, and there is a surplus for export. Of this production 85 per cent is yielded by coking ovens. Modern ovens, saving all by-products, gave 82 per cent of the total yield of coke in 1909, against 30 per cent in 1900.

The sources of the British production are as follows: Gas works, 168,000 tons; coke ovens, 120,000 tons; shale distillation (Scotland),

60,000 tons; blast furnaces, 21,000 tons. The amount of coke produced in modern ovens increased from 10 per cent in 1900 to 18 per cent in 1909.

The American production in 1910 increased 10,000 tons over that of 1909. This increase is due to the rapid construction of coking ovens, built for the recovery of by-products. At the close of 1910 the ovens numbered 4,078, and 1,200 new ovens were in course of construction. Of the total amount of coal coked during 1910 in the United States 17 per cent was so treated as to save all by-products. In 1900 the percentage was 5 per cent.

Reviewing this source of nitrogen it will be seen that it is limited to the world's consumption of coal. It will increase with this consumption, and probably for many years, at a more rapid rate than the growth of population. The average yield will also increase notably as the practice of coking coal prior to its use as fuel or for metallurgical purposes becomes more prevalent.

In the United States the present per capita annual consumption of coal is 5.5 short tons, or 11,000 pounds. One-fifth of this amount, or 2,200 pounds, is anthracite. If the remaining 8,800 pounds were coked before use, they would yield 20 pounds of nitrogen in a combined form. The actual yield to-day from this source is 0.6 pound of nitrogen. The annual per capita consumption of nitrogen in the United States is now 2.84 pounds. It will be shown later that it is technically feasible to utilize a large portion of the coal consumed so as to secure in the form of ammonia all of the nitrogen present.

THE WORLD'S SUPPLY OF COAL.

The coal deposits of the world are, however, limited. The dates when certain coal regions will be completely exhausted can be approximately established. Certain it is that the year will eventually arrive when the coal supply will have disappeared and when combined nitrogen can no longer be secured as a by-product of the manufacture of gas and coke. The latest estimate of the world's coal reserve (C. Engler, *Zeitschrift für angewandte Chemie*, 1911, p. 1843), fixes the total at 3,000,000,000,000 tons. Of this quantity, 1,400,000,000,000 belongs to Europe and the United States. The remainder is located largely in China.

The deposits in Europe and North America are as follows: Germany, 416,000,000,000 tons; Great Britain, 193,000,000,000; Russia, 40,000,000,000; Belgium, 20,000,000,000; France, 19,000,000,000; Austria-Hungary, 17,000,000,000; United States, 680,000,000,000. At the present rate of consumption the supplies will last as follows: Germany, 3,000 years; Great Britain, 700 years; remainder of Europe, 900 years; United States, 1,700 years.

PEAT AND SILT AS SOURCES OF NITROGEN.

Peat is vegetable matter undergoing slow decomposition with air excluded; it is the first stage in the formation of coal. Dried peat contains usually 1 per cent of nitrogen, along with about 60 per cent of carbon and 5 per cent of hydrogen. It can be used for fuel in such a way that at least three-quarters of the nitrogen can be recovered as ammonium sulphate.

The world's stock of peat is enormous and it is a stock that is gradually increasing. There are vast peat swamps in the United States and Canada the area of which can only be guessed. The extent of the peat bogs of northern Europe is better known. The following table will give an idea of the area of the peat bogs in the different European countries:

Countries.	Acres.	Per cent of total area.	Countries.	Acres.	Per cent of total area.
Finland.....	18,500,000	20	Ireland.....	1,200,000	5.8
Sweden.....	13,000,000	12.6	Germany.....	7,200,000	5.2
Russia.....	95,000,000	7	Norway.....	4,000,000	5
Denmark.....	600,000	6.2			

A bog averaging 5 feet in depth contains per acre about 47 short tons of nitrogen in the combined form. German peat bogs are usually from 9 to 13 feet deep, although depths as great as 80 feet are encountered. Germany's stock of reserve nitrogen in this form certainly exceeds 300,000,000 tons.

At present about 10,000,000 tons of peat are utilized annually as fuel. Of this amount Russia contributes over 4,000,000 tons. As the peat contains at least 25 per cent of water, the current annual production represents about 75,000 tons of nitrogen of which a large share, under proper conditions, can be secured in the combined form as ammonia.

Silt is closely allied to peat. The enormous deposits of fine mud in certain rivers and about their deltas contain large amounts of organic matter. Silt at the mouths of German rivers contains, when dried, up to 2 per cent of nitrogen. Dried silt can be used for fuel with the same advantage as peat.

POTASSIUM NITRATE AS A FACTOR.

Potassium nitrate, or saltpeter, is one of the oldest salts known to mankind, and is readily produced when organic matter decays in the presence of potassium carbonate and the nitric acid formed by bacterial action acts upon the potash compound. In hot countries the soil often becomes rapidly rich in saltpeter in the neighborhood of human dwellings; in such cases the saltpeter can be extracted from the earth by treatment with water. Usually the nitric acid is present chiefly in the form of calcium nitrate, on account of the presence of limestone in the soil. Natives add wood ashes to the solutions obtained by leaching the soil, and the calcium nitrate is thus changed into potassium nitrate. For many years there has been an annual production in India of saltpeter from this source amounting to 20,000 tons. Until 1850 this was the chief source of the saltpeter required by Europe for the manufacture of gunpowder and for use in the arts. Most of the current production of India is exported, the present price being \$75 per ton. A process has been perfected recently in India for avoiding waste and giving more of a modern industrial character to this primitive branch of manufacture. The plant for a daily production of 2,400 pounds costs only \$1,000, and a product 94 per cent pure is secured. There is a possibility that the Indian produc-

tion may assume much larger proportions than during the past 50 years. There are numerous caves in India and other countries where saltpeter has accumulated, and there are many localities where the formation of nitrates in the soil is specially noteworthy.

In the seventeenth and eighteenth centuries artificial "saltpeter plantations" were common in Europe and a few still remain. The favorable conditions for the production of nitrates in the soil are the following: Porous earth, allowing easy access of air and water; an amount of moisture barely sufficient to prevent dryness; the presence of an abundance of decaying organic matter, rich in nitrogen; a temperature ranging from 5° to 55° C., with 37° as the most favorable for bacterial action; weak alkalinity of the soil, due to the presence of carbonates of potassium, calcium, or magnesium.

Potassium nitrate invariably accompanies the sodium compound in the deposits of Chile. The latter contain ordinarily 25 to 50 per cent of sodium nitrate and 3 to 5 per cent of potassium nitrate. In a few localities of the arid regions, notably at Tacunga, in Peru, and at Cochabamba, in Bolivia, accumulations of saltpeter of some importance have been encountered.

The natural occurrence of the salt and its continued formation in certain regions, under favoring conditions, have to-day only the slightest influence upon the solution of the nitrogen problem, although less than a century ago they constituted almost the sole source.

SODIUM NITRATE, OR CHILE SALTPETER.

ORIGIN AND DISTRIBUTION OF THE SALT.

In the natural occurrence of this salt the world finds for the time being its chief source of combined nitrogen and the certainty that this supply is limited and is rapidly approaching the date of complete exhaustion gives to the nitrogen problem its acute character.

The one noteworthy region in which this salt is found in quantity, and from which its commercial designation is derived is the long arid stretch of Chile lying between the Pacific coast and the foothills of the Andes. It is about 430 miles in length, extending from 19° to 25° southerly latitude. There is no rainfall and no vegetation. North and south of the limits above given nitrate is found in small quantities, but not in sufficient amounts to warrant exploitation under existing circumstances.

With regard to the origin of these deposits, the theory of Nöllner is generally accepted. He assumed that the present plateaus of Atacama and Tarapaca were originally below the sea level. As they were gradually raised enormous amounts of seaweed or wrack were collected within the restricted area. As an inland sea was slowly formed, further quantities of the seaweed were carried over the low coast line during seasons of storm. This vast mass of marine vegetation decayed under the most favorable conditions of temperature for the action of nitrifying bacteria, and the product remained intact, as rain was almost unknown and there was no drainage. As sodium compounds predominate in marine growths, sodium nitrate was the main product of nitrification. The presence of iodine in the deposits and the presence of small amounts of potassium compounds, corresponding to the ratio between soda and potash in kelp ash, as well as various other minor facts, confirm this theory.

The distribution of sodium nitrate in the region in question is very variable. In much of the territory the soil near the surface contains small amounts of this substance, the percentage, however, being too low to warrant any effort at extraction. On the other hand, tracts are known where the nitrate-bearing strata analyze as high as 95 per cent of pure sodium nitrate. All the intermediary stages between this percentage and simple traces in the soil are encountered by the prospector.

FORMATION AND COMPOSITION OF NITRATE BEDS.

In all cases the nitrate-bearing earth forms a distinct stratum, ranging from a few inches to 16 feet in thickness. In most instances it varies between 20 inches and 7 feet. This stratum rests upon a soft clay, and is termed locally the "caliche." It is always covered by a top layer, the so-called "costra," which is closely compacted and varies in thickness from 4 inches to 5 feet. Guano and phosphates are often encountered in the costra. It consists largely of sodium sulphate and sodium chloride (ordinary salt), and contains, as a rule, 7 to 16 per cent of nitrate. The surface soil is sandy, occasionally clayey, and of variable thickness.

The caliche strata, which are now found sufficiently rich for treatment, show, ordinarily, the following range of composition, according to two recent reports (Plagemann, 1905; Semper and Michels, 1904):

Constituents.	Plagemann.	Semper and Michels.
	<i>Per cent.</i>	<i>Per cent.</i>
Sodium nitrate	25 to 30	15 to 65
Potassium nitrate	3 to 5	2 to 4
Iodine (as iodate)	0.008 to 0.25	0.06 to 0.2
Sodium chloride	25 to 30	20 to 30
Potassium perchlorate	2 to 5	(¹)
Insoluble	20 to 30	
Water	1 to 2	

¹ Small amounts.

Small amounts of calcium and magnesium salts, of chromates, borates, bromates, etc., are also found in the caliche. The covering stratum, the costra, may be regarded as a caliche that has lost much of its nitrate while retaining its chlorides and sulphates. Prospecting for available deposits of the nitrate is comparatively easy, as the strata lie so near the surface.

EXTRACTION AND PURIFICATION.

The method of extracting and purifying Chile saltpeter is simple. The surface earth on a field is removed, holes are driven into the costra and caliche, and by means of slow-burning blasting powder large masses are loosened and broken into blocks. The fragments coming from the caliche stratum are picked out by hand, loaded upon carts, and transported to the "oficina," or leaching works. Heavy hammers are often used to detach the caliche from the costra. At the oficina the caliche is crushed into small fragments and dissolved in boiling water. After clarifying, the hot saturated solution is

drawn off into wooden vats and allowed to crystallize. Such a solution yields 40 per cent of crude nitrate and 60 per cent of mother liquors, the latter being used for new quantities of caliche. Residues in the solution kettles, the so-called "ripios," contain 15 to 25 per cent of sodium nitrate. After standing for four days in the vats, the mother liquors are withdrawn, the crystals are allowed to drain, are washed with a very small amount of water, and then spread on platforms to dry in the sun. When dried they are ready for packing in sacks and shipment.

The crude salt thus brought into commerce contains from 95 to 96 per cent of sodium nitrate. This includes potassium nitrate, ranging from 8 per cent down to traces. The amount of nitric acid shown by analysis is customarily the sole factor for determining the value.

IMPROVEMENTS IN HANDLING THE SALT.

During the early years of the nitrate industry the mechanical equipment was exceedingly primitive and the processes used wasteful in the extreme. At the close of the last century the average loss of nitrate in handling caliche containing 35 per cent nitrate was no less than 32 per cent of the nitrate present. This was estimated by Bier-natzki as follows: Loss in transporting from field to oficina, 7 per cent; in crushing and dissolving, 2 per cent; in residues, 14.3 per cent; in mother liquors and in drying, 8.7 per cent.

During the past few years many improvements have been introduced at every stage of the process. Loss by transportation has been eliminated. Formerly solution in some works was effected in large cylindrical tanks 30 feet high and 15 feet in diameter, into which steam under a pressure of $3\frac{1}{2}$ atmospheres was driven. Each vat was capable of yielding over 130 tons of nitrate in 24 hours. In other works cars made of perforated sheet iron, containing the caliche, were lowered into great vats, in which the water was heated by coils of steam pipes. The cars were withdrawn later with the undissolved residues. Finally, series of tanks were introduced, practically identical with those used for lixiviating black ash in soda works by the Shanks process. Thanks to this improved equipment, it has been possible to reduce the loss of nitrates in the residues to 4 to 6 per cent, according to the nature of the caliche. The mother liquors, when no longer of use in dissolving fresh quantities of caliche, serve as a source of iodine. In every direction there has been a material lessening of the cost of production and a corresponding avoidance of loss of saltpeter, although this loss still amounts to about 15 per cent in the best conducted works. Important results have followed the introduction of the Shanks system of extraction vats. Formerly little attempt was made to treat caliche containing less than 50 per cent of nitrate. Now it is possible to utilize the poorer deposits containing as low as 17 per cent. Much of the costra now becomes available, and it is a common practice to send both costra and caliche together to the crushers without attempting to separate them. Further, it is now feasible to treat advantageously the residues of earlier years, containing 15 per cent of nitrate. All of these advances toward modern technical perfection in the exploitation of the nitrate deposits are important factors in the nitrogen question.

PRESENCE OF POTASSIUM PERCHLORATE.

One feature connected with this source of nitrogen is the presence of potassium perchlorate in the original caliche, and consequently in the commercial product. In certain regions the caliche contains notable amounts of perchlorate, reaching even 4 per cent. In other regions there is a total absence of this salt. In 1896, in Belgium, it was noticed that freshly sprouted plants were injuriously affected by applications of Chile saltpeter. Investigation showed that the saltpeter contained 1 to 2 per cent of perchlorate, and the toxic action of this salt on the tender rootlets of young plants causing them to shrink up, was soon after demonstrated. It was found possible to remedy this by a modification of the crystallization process embodied in the patents of Fölsch and Martin, and of Eger (German patents 125206 and 165310). In these methods advantage is taken of the differing solubilities of sodium nitrate and potassium perchlorate in hot and cold water.

In sections where perchlorate is relatively abundant the mother liquors are withdrawn from the crystallization vats while still comparatively warm. The crop of crystals at this stage is almost entirely free from perchlorate. The mother liquors are then cooled completely in other vats, yielding a nitrate with a high percentage of perchlorate. This second crop of crystals is then treated with cold water, which dissolves the nitrate and leaves the perchlorate in a fairly pure condition, ready to use as a commercial product. For a few years (1898-1901) Chile sent a considerable quantity of perchlorate to the European market for use in the manufacture of fireworks. The largest shipment amounted to 88 tons and was made in 1898. The modern production of potassium perchlorate by the electrochemical process is so cheap that the manufacturer in Chile was unable to compete successfully and the shipments ceased.

During the period 1898 to 1901 shipments of Chile saltpeter to Europe were comparatively free from perchlorate, averaging 0.25 per cent. Since 1901 less attention has been paid to the elimination of perchlorate and shipments are apt to contain a high amount of the impurity, reaching in some cases 3 per cent. More attention has been paid to this matter in Europe, and especially in Germany, than in the United States, where the amount of Chile saltpeter used for fertilizing purposes is relatively much less. It would, however, be well if the American supply were more closely controlled in this connection and the inspection of saltpeter intended for agricultural use made more rigid. The modifications in the crystallization process needed to eliminate the perchlorate, as outlined above, involve but a modicum of additional expense, even if the perchlorate is not utilized, and they are necessary in but a portion of the nitrate region.

STATISTICS OF THE CHILE SALTPETER INDUSTRY.

Shipments of Chile saltpeter to Europe began in 1825. The export to all lands reached 1,000 tons in 1830. In 1850 it was 25,000 tons; in 1870, 150,000; in 1890, 1,000,000; in 1900, 1,400,000; and in 1910; 2,308,000 tons. The export was divided as follows in 1910: Shipments to Europe, 1,651,000 tons; to the United States, 565,000 tons; to other lands, 92,000 tons. Of this total 154,000 tons were refined.

by recrystallization and contained over 96 per cent of pure nitrate. Prices for this grade were about \$0.85 higher per ton than for the usual 95 per cent quality. The refined saltpeter is demanded chiefly by American importers, who gladly pay from 2½ to 5 cents more per 100 pounds to secure it for use in the arts. It was estimated in Chile that the production was 128,000 tons in excess of the export.

The actual consumption of sodium nitrate in the chief European countries in 1910 was estimated to be as follows:

Countries.	Tons.	Countries.	Tons.
Germany.....	709,000	Spain.....	6,400
France.....	336,000	Austria-Hungary.....	5,600
Belgium.....	262,000	Sweden.....	2,000
Holland.....	132,000	Total.....	1,611,000
United Kingdom.....	120,000		
Italy.....	38,000		

In 1905 Prof. Jurisch made the following estimate of the per capita consumption of Chile saltpeter in the leading countries:

Countries.	Pounds.	Countries.	Pounds.
Belgium.....	44.0	United States.....	7.3
Germany.....	19.0	United Kingdom.....	5.0
Holland.....	14.7	Austria-Hungary.....	3.1
France.....	12.7	Italy.....	3.0
Denmark.....	10.4	Switzerland.....	1.4
Sweden.....	9.5	Norway.....	.6

The per capita consumption of the entire world in 1910 was 3.34 pounds. In Europe nearly 80 per cent of the Chile saltpeter imported is used as fertilizer; about 15 per cent is required for the manufacture of nitric acid; and the remainder is used in the lead chambers of sulphuric-acid works, in the conversion to potassium nitrate and sodium nitrite, and for minor purposes.

Relatively the use of Chile saltpeter in the United States as a fertilizer is much more limited than in Europe, amounting to about 13 per cent of the total consumption. This consumption for 1905 was estimated by C. G. Monroe as follows:

Industries.	Short tons.	Industries.	Short tons.
Explosives.....	133,000	Glass making.....	12,000
Enameling, fluxing, pickling, etc.....	68,000	Dyestuffs.....	260
Fertilizers.....	42,000	Total.....	322,260
General chemicals.....	38,000		
Nitric and sulphuric acids.....	29,000		

FINANCES OF THE EXPLOITING COMPANIES.

The exploitation of the nitrate fields of Chile is in the hands of a number of companies. The combined capital of the 62 existing companies was \$112,000,000 in 1905. In that year they operated 90 separate works. The number had increased to 113 in 1908 and was 158 on July 1, 1911, with several more in process of construction. Much English and German capital is invested, and of late years

American capital has been increasingly attracted to this field. The sum total invested in the industry is estimated at \$136,500,000 and is divided as follows: British, \$53,500,000; Chilean, \$51,500,000; German, \$16,500,000; other, \$15,000,000.

The 13 English companies report, as a rule, a very profitable year's business during 1910. The five largest companies declared dividends of 20, 15, 8, 6, and 10 per cent, following the order of their importance. The price of nitrate f. o. b. the Chilean coast, including export duty, varied from \$32.34 per short ton in July, 1910, to \$36.18 in July, 1911. The production during the current "nitrate year" ending June 30, 1912, will materially exceed that of the previous year.

No attempt is made by the Chilean Government to restrict the output, although there is an export duty of \$11.16 per short ton on saltpeter. From this one source 60 per cent of the Chilean revenues are now derived. During the 31 years beginning with 1879 the industry and agriculture of the world have paid a tax of \$425,000,000 to Chile.

COST OF PRODUCING SODIUM NITRATE.

Statements are naturally variable regarding the actual costs of producing Chilean saltpeter. It is certain that the average cost for extracting from a given grade of nitrate earth is steadily falling as modern technical methods and appliances are introduced. On the other hand, these very methods allow of the utilization of poorer grades of earth with a fair profit. Certain items of expense are increasing; for instance, a workman in the nitrate works produces 30 per cent less saltpeter to-day than was the case 30 years ago, even with the aid of improved machinery and processes. In 1899 Behrend estimated the cost of fuel at \$1.20 per ton of nitrate. In 1904 Semper and Michels estimated the cost of a ton of nitrate at the works at \$6 to \$18, according to the location and methods used. In 1905 Plagemann estimated the total cost of saltpeter, packed in sacks and delivered on board ship, export duty included, as ranging between \$22.37 and \$28.08 per ton. In 1908 (Daily Consular and Trade Reports, No. 3327) the total cost of nitrate delivered on board ship ranged from \$35.40 to \$40.77 per ton.¹

From a study of the conditions in Chile made during 1910, it appears that the cost of a modern nitrate factory, producing 5,000 tons monthly from 32 per cent caliche, is about \$750,000. The average cost of handling 1 ton of caliche is as follows: Boring and blasting, \$0.10; sorting, \$0.64; tool repair, \$0.04; hauling to factory, \$0.24; inspection, \$0.04; total, \$1.06.

This expense is practically a fixed charge, no matter what the richness of the nitrate earth may be. If the caliche contain 30 per cent of saltpeter and the actual yield is 22 per cent, these preliminary outlays amount to about \$4.80 per ton of pure nitrate. The actual cost of the commercial product, 95 per cent nitrate, delivered at the wharf averages \$12 per ton, without including interest on investment, amortization, or export duty. In extreme cases the figure mounts as high as \$17; under very favorable conditions it is but little over the cost of the caliche.

¹ Consul Alfred A. Winslow, of Valparaiso, reports that the use of petroleum in the nitrate works is reducing the fuel bill 20 per cent. Twelve works are equipped for burning oil and several more are installing oil-burning plants.—B. of M.

In 1904 some works showed a net profit of \$8.33 per ton. In 1908 works equipped with the Shanks extraction system, with residues containing less than 10 per cent of nitrate, made net profits equal to one-half the selling price at the wharf. At present (January, 1912) the average net profit per metric ton is estimated at \$5.25. The prices asked for nitrate land are variable, but usually low. An English company recently acquired a large tract upon the agreement to pay a royalty of \$0.76 per ton of nitrate.

FREIGHT RATES TO EUROPE.

Freights to Europe have varied between \$2.92 and \$6.83 per long ton during the past decade. The following table shows the variations in the maximum and minimum freight rates to Europe:

Years.	Maximum.	Minimum.	Years.	Maximum.	Minimum.
1901.....	\$6.83	\$5.19	1906.....	\$4.87	\$4.87
1902.....	6.08	3.04	1907.....	4.26	1.04
1903.....	4.87	3.04	1908.....	4.87	2.82
1904.....	4.87	3.49	1909.....	4.87	3.41
1905.....	4.87	4.56	1910.....	4.87	3.43

DISSOLUTION OF SYNDICATE AFFECTS PRICES.

For several years there was a powerful syndicate of nitrate producers in Chile, but the agreement terminated in 1909 and has not since been renewed. Since the date of the dissolution there has been a very rapid increase in new establishments, a marked tendency to overproduction, and, very naturally, a lowering of prices. Liverpool quotations averaged \$53.65 per ton in 1907 (the highest since 1900); \$46.52 per ton in 1909; and \$44.79 per ton in 1910.

Efforts were made in 1910 to revive the syndicate, but without result; the most powerful companies, those best able to face an era of low prices, refused to bind themselves. The leading interests are, however, united in an organization termed the "Nitrate Propaganda Association," which seeks in every possible way to extend the market for saltpeter. The association possesses a fund of \$600,000, to which the Government has contributed \$195,000.

THE IMMEDIATE FUTURE OF THE INDUSTRY.

So far as the immediate future of the nitrate industry is concerned, it is probable that despite the rapid increase of the world's demand, amounting to about 10 per cent annually, should the present era of unrestricted competition continue the smaller and weaker firms will steadily be forced to abandon the struggle. Modern equipment and the introduction of highly perfected processes of extraction will diminish the still very serious waste of nitrate, apparently unavoidable at present. Poorer and poorer fields can gradually be operated with at least a moderate profit, and the refuse heaps of past years can be subjected to modern exhaustive treatment, very much as has been done with the tailings of California gold deposits. With the increase in the world's production of ammonium compounds and the growth

of the various industries manufacturing synthetic nitrogen compounds, the time may soon come when it will be necessary to reduce the high export duty on saltpeter.

An all-controlling factor in the nitrogen question is the actual reserve stock of saltpeter in the Chilean Desert that may be profitably extracted. This is a field in which, at the best, a large element of uncertainty exists.

POSSIBLE EXHAUSTION OF THE CHILEAN DEPOSITS.

In 1903 Semper and Michels made a careful study of all existing data and, with due regard to the steady growth of the export, estimated that the entire Chilean field would be completely exhausted by 1947. In 1904 Vergara, the statistician of the Chilean Government, fixed 1923 as the date at which the fields could no longer meet the world's demand. In 1905 Plagemann, on the basis of very careful calculations, fixed 1923 as the date for the decline of the industry and looked forward to its complete extinction in 1940. These pessimistic conclusions led the Government of Chile to appoint a commission of experts, which reported in 1907 upon the nitrate reserves. They stated that the nitrate territory in possession of the nation amounted to at least 7,720 square miles. Nitrate territory in private ownership was estimated at from three to four times this area. If only one-half of the publicly owned area is susceptible of profitable operation, this half should yield at least 450,000,000 tons of saltpeter. Three or four times this amount may be had from privately owned lands, so that there should be no question of an exhaustion for centuries.

Conservative opinion in Germany tends to regard the known area of nitrate-bearing earth as able to meet all prospective demands upon it for at least the next 50 years, with possibilities of newly discovered territory within or outside of Chile. The Nitrate Propaganda Association of Chile issued a statement at the close of 1910 in which the total quantity of saltpeter still available for extraction is estimated at 246,000,000 tons. This estimate would also indicate an ability to meet prospective demands for possibly half a century, unless the demands for the world's wheat fields become too urgent.

In 1909 Prof. Grandea, of Paris, the leading French authority on fertilizers, estimated the remaining supply at 220,000,000 tons, as a certain minimum. With an annual increase in consumption of 50,000 tons, he calculated that in 1955 the world's demand would reach 5,000,000 tons per annum, and that 17 years later the supply would be exhausted. It is not impossible that additional nitrate territory may be discovered in Chile, despite the widespread prospecting of the past 80 years. In 1906 the Finance Ministry announced the discovery of hitherto unknown deposits in the two Provinces of Tocopilla and Antofagasta.

SODIUM NITRATE IN ASIA AND AFRICA.

The quest of sodium nitrate outside of Chile must naturally be limited to localities where geographical conditions and geological history similar to those encountered in Chile may have combined. From time to time reports of newly found nitrate districts have been

published, but as a rule the occurrences are insignificant in extent, or the percentage of saltpeter is too low to warrant industrial treatment.

In the vicinity of the oasis of Tuat, in the Sahara, there is a deposit of some extent, of which little is known. The requisite water for extraction is lacking, and the region is not easily accessible. In Russian Turkestan the presence of extensive deposits of nitrate-bearing earth had long been known. The absence of railroads rendered any attempt at industrial extraction useless. On the completion of the Trans-Caspian Railway it was proposed to erect the necessary works at Schor-Kala, near the station of Geok-Tepe. At this point the railway passes through an enormous marsh. In 1888 the report of an examining engineer was to the effect that millions of poods (pood = 36.112 pounds) of nitrate were available at this locality. Experts who collected samples in 1890 reported that the upper stratum of the marshy tract contained small amounts of saltpeter, ranging from 0.2 to 0.4 per cent; the underlying stratum, however, showed on analysis no less than 77.4 per cent. Magnesium sulphate is the chief salt present with the nitrate. It is possible with modern methods of extraction, and with a demand from eastern Russia or Siberia for fertilizer, that this occurrence may represent an asset of some value to Russia.

In Egypt there is nitrate land east of the Nile, about 450 miles south of Cairo. The reports of a Government commission, published in 1895, state that the area covers much of the territory lying between latitude 24° and 27°, longitude 28° and 34°, and that the quantity is practically inexhaustible. The most notable deposit constitutes a range of low hills, 15 miles in length, lying at the foot of a lofty chain of limestone. The nitrate earth is essentially a marl, containing an average of 15 per cent calcium and sodium nitrate, and is protected by a thin cover of limestone. In the rainy season great quantities of the nitrate are leached out and lost. It would appear, however, as if the losses were quickly repaired by nitrification. The origin of the deposits is uncertain; there is no trace of animal or vegetable life in the hot valley. The earth has long been used as a fertilizer by native agriculturists, who test the quality of the earth by tasting it. Without the aid of this fertilizer agriculture between Assuan and Armant would be practically impossible. So far as known no attempt has been made at a technical extraction of the saltpeter present, but there has probably been a much increased use of the earth itself, as shipments of Chile saltpeter to Egypt have fallen off noticeably during the past few years. Water is at hand and fuel is cheaper than in Chile. It is therefore probable that with modern methods this 15 per cent deposit could be advantageously worked. Very exact data on the status of the Egyptian deposit are lacking.

IMPORTANT DEPOSITS IN CALIFORNIA.

Nitrate deposits of distinct interest to American agriculture are found in Inyo, Riverside, and San Bernardino Counties, Cal. The territory in San Bernardino County is owned by the California Nitrate Co. and covers an area of 12,160 acres. A surface layer of clay contains small amounts of nitrate and beneath this is a stratum that has been less affected by the leaching action of rain. Samples taken

from this stratum analyze from 7 to 23 per cent of nitrate. The average is about the same as for the Egyptian deposits and the facilities for extraction are very similar. The fields bear little resemblance to those of Chile, but the abundant supply of pure water is undoubtedly an advantage. The region bears the name of Death Valley and seems to have constituted the banks of a former sea. The total area, about 20 square miles, is of course insignificant as compared with the reserve Chilean territory. Under the most favorable conditions the total yield would probably be less than the present amount of the world's consumption for one year.

At Vivet Eye, in Riverside County, near the Colorado River, there is an area of about 10 square miles covered largely with a crust of white salts about 1 foot in thickness. This crust contains from 7 to 14 per cent of nitrate and may be of value, although at present it is not promising. Other sections of supposed nitrate along the Colorado prove to be of a superficial nature. A percentage of 1.5 per cent at the surface rapidly decreases on digging lower. The nitrate seems to come from the leaching of neighboring slate strata, which contain from 1 to 4 per cent of nitrate. For the local demands of California agriculture such occurrences are worthy of careful study, as the question of transportation comes into play, and ultimately the residues of any systematic extraction could be utilized in the immediate neighborhood, which is out of the question in the arid wastes of Chile.

POSSIBLE DEPOSITS IN PERU AND BOLIVIA.

It has seemed probable that the arid regions of Bolivia and Peru might contain deposits of nitrate, as they form essentially a continuation of the Chilean waste. Slight occurrences have been reported in Bolivia. In 1906 it was stated by the German consul general in Valparaiso that a very extensive deposit had been located in Peru, and that the Government had taken possession of the land. A Peruvian law forbids the ownership of nitrate territory by private persons. Since then there has been no indication of any effort to extract nitrate from this source. As Peru has sufficient guano to more than cover the present domestic demand for nitrogen fertilizers, it is possible that the nitrate tract in question has been reserved for future needs. For two years the Peruvian import of Chilean saltpeter has very sensibly diminished, a fact that indicates the existence of a local source.

REVIEW OF THE SALTPETER SITUATION.

It is evident that the deposits of nitrate outside of Chile, barring new and not very probable discoveries, possess a purely local and transient importance. They have no bearing upon the world's problem.

The world's demand for nitrogen is rapidly increasing. This demand can be met in four ways, as follows:

1. By a temporarily increased supply of saltpeter from deposits, soon, however, to be exhausted.
2. By an increased supply of ammonia as a by-product of coal and peat, dependent on a general reform in the use of these materials as fuel and limited by the extent to which they may be used as sources of light and heat, and

limited, further, in point of time, by the world's supply of fossil fuel, with a possible exhaustion within a few centuries.'

3. By the closest economy in preserving all waste forms of combined nitrogen, vegetable or animal, so that they may be utilized as plant food.

4. By the technical transformation of atmospheric nitrogen into combined forms available for the needs of agriculture and the arts.

Of the foregoing ways of meeting the demand for combined nitrogen, the first is of temporary importance. The second is of much more importance, for, theoretically, the coal now consumed is capable of producing much more combined nitrogen than the world at present demands. No. 3 likewise offers vast possibilities, as the solid and liquid excreta of the world's population represents annually nearly 8,000,000 tons of nitrogen; for the United States it amounts to nearly 450,000 tons, or 45 per cent more nitrogen than the world now consumes in the form of Chile saltpeter. Economic students in Europe, and especially in Germany, feel that the time has come when the best talent must be directed to solving the problem of utilizing industrially the nitrogen of the air.

SYNTHETIC PRODUCTION OF AMMONIA.

EARLY PROCESSES.

Attempts to bring about a direct union between hydrogen and nitrogen were made at an early date. Reynault, in 1846, showed that by passing an electric spark through a mixture of the two gases, ammonia could be produced. Perrot, St. Claire-Deville, Berthelot, P. and A. Thénard in France, and Donkin in England, studied the problem during the next 30 years. It was found that union could be effected also by the ordinary electric discharge. The yield was, however, exceedingly slight. As soon as a small amount of ammonia was present in a gaseous mixture, the tendency toward decomposition into the original elements was practically equivalent to the tendency to unite. St. Claire-Deville secured somewhat more favorable results by carrying on the synthesis in the presence of a gaseous acid, such as hydrochloric acid. Under such conditions ammonium chloride was gradually deposited in the solid form.

During the past decade the possibility of this synthesis has gradually ceased to possess a purely scientific interest, and has become a matter of technical importance. This was due partly to the recognition of an impending nitrogen problem, partly to the fact that comparatively pure nitrogen and hydrogen have very recently become available for the demands of chemical industry at relatively insignificant cost. The liquefaction of air, the production of generator gas and water gas, the rapid progress of aeronautics, with its insistent demand for cheap hydrogen, and finally the advance in electrolytic chemistry, have all been factors in bringing about this latter condition, which is fundamentally essential as the basis of a technical process.

In 1902 De Hemptinne showed that pressure was favorable to the reaction, as well as low temperature and relatively short sparks. In 1904 Perman and Atkinson showed that certain catalytic substances, especially mercury, iron, and platinum, were helpful to the reaction. These two elements in the problem—pressure and catalytic action—proved to be the controlling factors.

HABER'S METHOD.

Prof. F. Haber, of Karlsruhe, with the aid of G. van Oordt, published in 1905 and 1906 a series of papers in which the general conditions for a successful solution were clearly defined. The necessity of operating at a relatively low temperature was fully demonstrated. Above a dull-red heat no catalytic agent, even under high pressure, could produce more than traces of ammonia in a mixture of one volume nitrogen and three volumes hydrogen. A table was constructed showing the equilibrium possible at different temperatures, i. e., the percentage of ammonia which could be present in such a

gaseous mixture at a given temperature without further change. Thus at 327° C. 8.72 per cent of ammonia could be present, with 68.46 per cent of hydrogen and 22.82 per cent of nitrogen, without further increase or diminution of the amount of ammonia. At 1,020° C. only 0.012 per cent of ammonia could be present.

The conditions being outlined, it remained to settle by practical tests the choice of the best catalytic agent and the most favorable combination of temperature and pressure that could admit of technical application. The necessary experiments were concluded in 1909, when Prof. Haber patented the results (German patents 229126 and 238450). Early in 1910, with the aid of R. le Rossignol, he published the details of his work.

Two essential features characterize the new process. The mixture of gases is maintained under a pressure of from 175 to 200 atmospheres, and the reaction takes place in the presence of uranium as a catalytic agent.

OPERATION OF THE PLANT.

The operation and the requisite plant are by no means complicated. The mixture of one volume of nitrogen to three volumes of hydrogen—corresponding to the formula of ammonia, NH_3 —is forced under a pressure of at least 175 atmospheres into a steel cylinder, where the temperature is maintained at 500° C. In the cylinder there is a certain amount of powdered uranium. In the presence of this metal, which remains unchanged and exerts its catalytic power for an indefinite time, the two gases combine to form ammonia, under the given conditions of pressure and temperature. The reaction is rapid at first but decreases steadily in intensity. When ammonia gas forms about 8 per cent of the contents of the cylinder, the reaction has become so slow that the product must be removed. This can be effected by allowing the contents of the cylinder to pass into a vessel, in which the gases may be cooled down to the point at which ammonia is liquefied. In the liquid form it is easily withdrawn by a tap from the apparatus. The ammonia may likewise be withdrawn by bringing these sufficiently cooled gases in contact with such an acid absorbent as sulphuric acid. In either case the residual uncombined mixture of nitrogen and hydrogen is forced back by a pump into the reaction cylinder.

The plant consists therefore of a reaction cylinder, a cooling chamber, and a force pump. The latter keeps the supply in the reaction cylinder constant under a fixed pressure. There is a continuous circulation back and forth between the cylinder and the cooling chamber. From the latter ammonia is withdrawn at regular intervals in the liquid or gaseous form or after absorption as an ammonium salt in solution.

EXPERIMENTS WITH CATALYTIC AGENTS.

The catalytic agent employed is the most interesting feature in the process, as in the analogous industrial method of manufacturing sulphur trioxide by the aid of platinum sponge. Osmium, a member of the platinum group of metals, was also found to be the most effective agent in bringing about the combination of nitrogen and hydrogen. The available supply of osmium is, however, extremely

limited. The entire amount in the earth's crust is estimated by Auer von Welsbach at between 200 and 300 pounds.

Further experiment has shown that the more common metal uranium is nearly as effective as osmium, and it has been adopted as the most practical and serviceable material for the purpose. The product containing uranium carbide, secured from the action of carbon on uranium oxide in the electric furnace, is an especially convenient form. When brought in contact with the mixture of nitrogen and hydrogen under pressure it absorbs nitrogen and falls into an extremely fine powder, which possesses the catalytic property in a high degree.

In a later patent (German No. 238450) the inventor states that yields of over 2 per cent can be secured when so inexpensive a catalytic agent as iron is employed, provided the pressure be increased so as to range from 200 to 250 atmospheres.

THE BADISCHE ANILIN- UND SODAFABRIK.

Prof. Haber's process has come under the control of the Badische Anilin- und Sodafabrik, of Ludwigshafen, the leading chemical company in Germany, which is devoting particular attention to the solution of the nitrogen question. It is actively engaged in perfecting this synthetic process so as to have it ready for technical purposes when the "psychological moment" arrives.

A similar policy was followed by the company after it had perfected the synthetic manufacture of indigo before it actually placed the commercial product on the world's market (1897). It has invested large amounts in the development of the processes for the manufacture of nitric acid and the nitrates from atmospheric nitrogen, and possibly deems it best to delay the appearance of any competing nitrogenous compound.

The patents of the "Badische" are as follows: In German patents 223408 and 235421 it covers the ground generally by combining the use of high pressure, elevated temperature, and osmium as a catalytic agent. In a later patent (Austrian patent 45010) it protects the feature requisite to making the process continuous—the withdrawal of the compressed gas, when sufficiently enriched by the formation of ammonia, for the refrigeration, and the separation of the ammonia in the solid or liquid form, the return of the residual gas to the reaction chamber, the replacement of the eliminated ammonia by fresh supplies of the mixture of nitrogen and hydrogen, and the transfer to the latter of the heat withdrawn from the fractions undergoing refrigeration.

In patents secured during 1910 (French patent 425099, English patent 20127) and in 1911 (English patent 61) the company states that when iron is used as a catalytic agent its activity is much enhanced by the presence of other substances, more particularly of other elements of the iron group. It also announces the use of molybdenum and molybdic acid as valuable catalytic agents after first being heated in a current of ammonia and changed into nitride. For the purpose of protecting the walls of the reaction chamber from deterioration, the catalytic agent is contained in an inner tube or vessel; the mixture of gases enters in the outer space between the external walls of the reaction chamber and the tube, then passes into

the latter, and finally is conducted directly into the chamber for separating the resultant ammonia. Undoubtedly many further perfections in process and apparatus will be recorded in the form of patents during the next few years.

DETAILS OF PROCESS AND APPARATUS.

The three essential items in the cost of producing ammonia by this synthetic method are plant, material, and fuel. The plant for such an industrial process will of necessity be somewhat of a novelty in technical construction. Hitherto chemical operations on a large scale carried out under a pressure of 200 atmospheres have been unknown. The rapidly growing industry of compressed and liquefied gases has shown that there are no great difficulties in the way of constructing the requisite plant. Reaction chambers must necessarily possess a narrow diameter. Steel flasks of 2.75 inches inner diameter, with walls 0.2 inch thick, used in this synthesis easily sustain a pressure of 200 atmospheres. The inert nature of the two gases employed and the chemical properties of the product render it easy to prevent deterioration by corrosion, and insures a comparatively long life for the more massive forms of apparatus, and probably also for connections, taps, and other minor accessories. Pumping outfits adequate for effective work in this process are already in use for liquefying air and other gases, and for compressing gases for transportation. Hydrogen and oxygen usually are sent in steel flasks under a pressure of 150 atmospheres.

With regard to the consumption of material there probably will be a small item of expense in connection with the deterioration of the catalytic substances, as in other contact processes; less probably than in the manufacture of sulphuric acid.

COST OF NITROGEN AND HYDROGEN.

Nitrogen is now supplied for industrial purposes by the Linde, Pictet, Claude, and other methods at exceedingly low rates. In France prices range from 2 to 10 centimes per kilo (0.18 to 0.9 cent per pound). In Germany 3 pfennigs per kilo (0.32 cent per pound) is not an uncommon rate. Herr Linde states that in his smaller machines, yielding 100 cubic meters per hour (cubic meter = 35.314 cubic feet), can supply 99.5 per cent nitrogen (0.5 per cent oxygen) for 6 pfennigs per cubic meter (1.25 kilo), or 0.648 cent per pound. Very large plants can produce the gas somewhat more cheaply.

Hydrogen is now sold at Griesheim and Bitterfeld, in Germany, at 10 pfennigs per cubic meter (89.6 grams); this is about 1.116 marks per kilo, or 12 cents per pound. As hydrogen constitutes 17.6 per cent by weight of ammonia, the quantity required to produce 1 pound of ammonia would cost 2.11 cents, and to produce 1 kilo 4.65 cents, or 19.5 pfennigs. Further, the hydrogen necessary to produce 1 kilo of combined nitrogen in the form of ammonia—i. e., 1.21 kilos of ammonia—would cost 5.62 cents, or 23.6 pfennigs. With ammonium sulphate selling at a rate which gives to its nitrogen content a value of 1.25 marks per kilo, or about 13 cents per pound, the value of the nitrogen present, after deduction of the cost of the sulphuric acid, is well above 1.15 marks per kilo (12 cents per pound). There is

evidently here an unusually wide margin under existing price conditions to cover the expense of manufacture. Where circumstances permit the direct use of the hydrogen now liberated in the electrolytic manufacture of chlorine and the alkalies, as at Griesheim and Bitterfeld, an admirable utilization of what is now often a waste product could be attained. Germany produces annually 10,000,000 cubic meters of hydrogen (896 metric tons) as a by-product of the electrolysis of the alkaline chlorides. The same can be said of the hydrogen liberated in the electrolytic production of oxygen for commercial purposes from solutions of alkaline hydroxides.

PROCESSES FOR PRODUCING CHEAP HYDROGEN.

The Maschinenfabrik Oerlikon is now producing hydrogen on a large scale by electrolysis, using a solution of potassium carbonate as electrolyte. This hydrogen contains 1 per cent of oxygen; the oxygen produced at the same time contains 2 per cent of hydrogen. The Heraeus Co., in Hanau, uses as electrolyte a 20 per cent solution of caustic potash maintained at a temperature of 60° to 70° C. Both firms require an expenditure of 6 kilowatt hours per cubic meter of hydrogen. Where electric power costs 80 marks (\$19.04) per horsepower year, as is frequently the case in Germany, this means an outlay of 7½ pfennigs per cubic meter of hydrogen for electric energy, or 9 cents per pound. As each cubic meter of hydrogen involves a production of one-half cubic meter of oxygen, valued ordinarily at 12 pfennigs per meter, it is possible to produce hydrogen electrolytically, with great economy, at all points where there is a continuous demand for oxygen in large quantities.

The fact that large amounts of hydrogen are liberated in the manufacture of oxalic acid by the fusion of sawdust with caustic alkalies, or still better, by the new American process using corn cobs, has apparently been neglected. This source of the gas should not be disregarded in any new adjustment of chemical industrial plants with a view to the utilization of gaseous by-products. Manifestly it is desirable to locate the manufacture of synthetic ammonia immediately adjacent to industrial sources of hydrogen, so as to avoid the very material expense of compression and transportation. Hydrogen compressed in steel flasks, under a pressure of 150 atmospheres, sells in Germany at 50 to 90 pfennigs per cubic meter ($\frac{1}{3}$ to $\frac{2}{3}$ cent per cubic foot), delivered at a railway station ready for shipment. In very large quantities prices range down to 20 pfennigs. Nitrogen can be prepared at any point, directly from the air, by any of the methods now employed for the use of the pure gas in the manufacture of cyanamide. Should the manufacture of synthetic ammonia be inaugurated on a large scale the above-mentioned sources of hydrogen would obviously be unable to supply more than a fraction of the quantity needed. Other cheap methods of furnishing hydrogen gas for aeronautic purposes are now being rapidly perfected. More particular mention may be made of the following.

PASSING STEAM OVER GLOWING IRON.

The Internationale Wasserstoff Aktien-Gesellschaft, of Frankfurt, has established on an industrial scale, the manufacture of gas by

passing steam over glowing iron. Pyrites is found by the company (German patent 220889) to be the best material for use in the alternating operations of reduction and oxidation, as it retains its porous character. There is no tendency to fall to powder or to cake and thereby delay the process of reaction, more especially when undergoing reduction to the metallic state.

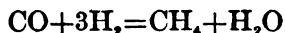
WATER GAS AS A SOURCE OF HYDROGEN.

Water gas, which contains on an average 48 per cent hydrogen, 43 per cent carbon monoxide, 4 per cent carbon dioxide, 4 per cent nitrogen, and small amounts of oxygen and methane, is an economical source of hydrogen. The oxides of carbon may be removed by suitable absorbents, such as alkaline hydroxides, cuprous chloride, etc. Frank passes the gas over calcium carbide at 300° C., securing an almost pure hydrogen. More economical is the separation by the use of compression and refrigeration, analogous to the method used in the separation of the constituents of the air. A company has been organized in Germany to produce hydrogen by this process, using for the purpose, when possible, the Dellwick water gas, which averages 51 per cent of hydrogen and 42 per cent of carbon monoxide. Such a gas in the Linde apparatus easily yields a product containing 97 per cent hydrogen, 1 per cent nitrogen or less, and 2 per cent carbon monoxide. The small amount of the latter can be readily removed by passing the resultant gas through a cuprous chloride solution. From this solution it can afterwards be expelled by boiling, supplying perfectly pure monoxide for use as a fuel gas. By a recently patented process the residual carbon monoxide can readily be removed by bringing the gas, while under high pressure, in direct contact with soda lime. The hydrogen is then over 99 per cent pure, containing less than 1 per cent of nitrogen as the only impurity. The remainder of the carbon monoxide, originally present in the water gas, is secured in this process, likewise in a form admirably adapted for fuel purposes, the liquefied gas containing 85 per cent. It serves to supply the necessary power for the entire operation.

Noteworthy in this connection is the isolation of fairly pure oxygen in considerable quantity from the liquid air used for refrigeration. As the amount of this oxygen is readily controlled it is exceedingly easy to secure oxygen and hydrogen in the ratio by volume of 1 to 4, the proportion needed for the most effective results in autogenetic welding. As electrolysis yields the gases in the proportion of 1 to 2, one-half of the oxygen is ordinarily lost. The 99 per cent hydrogen gas can be furnished at a maximum rate of 12 pfennigs per cubic meter (14.4 cents per pound). The purer gas, containing 99.2 to 99.4 per cent hydrogen, would cost 15 pfennigs per cubic meter (18 cents per pound). This Linde-Frank-Caro method—so named after the inventors of the different features therein combined—has been installed in various parts of Germany and is doing good work. The cost of production on a large scale will ultimately sink materially below the rates given.

By the Cedford process the greater part of the carbon monoxide in the water gas is removed by liquefaction and fractionation and can be used for heating purposes. The residual gas, rich in hydro-

gen and poor in monoxide, is passed over nickel as a catalytic agent, with the result that the oxide is reduced to methane, thus:



The result is a good illuminating gas containing about 30 per cent methane and 62 per cent hydrogen. The methane can easily be decomposed into carbon and hydrogen, as will be seen further on.

The Griesheim Elektron Co. has perfected a method (German patent 229406) by which the carbon monoxide in water gas is almost entirely replaced by hydrogen. In a special form of apparatus the gas, with the requisite amount of steam, passes at the proper temperature through wire gauze composed of catalytic metals, such as iron, nickel, or platinum. The result is that carbon dioxide is formed in abundance, and through rapid cooling and lack of contact with the catalytic agents, there is little or no reduction to the form of the monoxide. The requisite temperature can be maintained by allowing a limited amount of oxygen to enter into the gas current—or even air if there is no objection to having nitrogen present in the residual hydrogen—after the carbon dioxide has been absorbed by lime or other suitable agents. This method would seem to promise an especially economical source of hydrogen for use in the synthesis in question.

W. Näher and K. Müller claim (German patent 237283) to secure much the same result by passing water gas fresh from the generator, with the requisite amount of steam, over rhodium or palladium asbestos, as contact materials, at the temperature of 800° C. The resultant carbon dioxide is removed by the customary absorbents, and nearly pure hydrogen remains.

Another method perfected by the Griesheim Elektron Co. is likewise yielding very good results. Water gas, hot from the generator, is passed into a heated retort, charged with quicklime, in company with a current of steam. The carbon monoxide reacts with the lime and steam, forming calcium carbonate and hydrogen:



The elimination of the monoxide is very complete. According to the size of the plant the hydrogen produced (which contains the nitrogen originally present in the water gas) costs from 8 to 10 pfennigs per cubic meter (10 to 12 cents per pound).

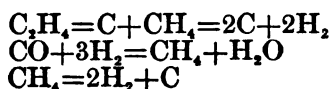
Dr. F. Sauer (German patent 224862) claims to get very satisfactory results by treating water gas with an excess of superheated steam, securing in a continuous uninterrupted current a mixture of steam, carbon dioxide, and hydrogen. The latter is easily isolated in a relatively pure condition.

HYDROGEN FROM ILLUMINATING GAS.

Several processes have been devised for utilizing illuminating gas, more particularly for aeronautic purposes. W. von Oechelhäuser has shown that by passing coal gas over coke at temperatures above 1,200° C. the specific gravity is lowered from 0.41 to 0.225. Most of the methane and all of the other hydrocarbons are split up into carbon and hydrogen. The resultant gas contains 80.7 per cent hydro-

gen, 6.9 per cent methane, 7.3 per cent carbon monoxide, and 5.1 per cent nitrogen. Such a gas costs 2 to 3 pfennigs per cubic meter more than the illuminating gas used in its preparation (pfennig=\$0.00238). It is sold at 10 to 13 pfennigs per cubic meter. Here, again, by use of the Linde machine, the methane and carbon monoxide can easily be removed. A process very similar to the above has likewise been patented by the Berlin Anhaltische Maschinenbau Actien-Gesellschaft. The oxides of carbon are completely removed, and the resultant gas has a specific gravity of 0.085 to 0.097 ($H=0.0693$).

O. Nauss (German patent 226609) alters the process by passing coal gas over suitable catalytic agents so as to change the carbon monoxide completely into methane. His method consists essentially of three stages: The gas is first passed at temperatures from 1,000° to 1,200° C. through retorts or chambers containing coke and fragments of pottery coated with iron, nickel, or cobalt in order to decompose the heavier hydrocarbons and part of the methane. It next passes through similar chambers at temperatures of 250° to 300° C. to reduce the carbon monoxide to methane. Finally, it passes again through chambers at the higher temperature to decompose the methane. The three reactions are as follows:



Rincker and Wolter use instead of coal gas the oil gas employed ordinarily for lighting railway trains. It is obtained by the destructive distillation of the heavy residual oils of petroleum, lignite tar oil, etc. It contains no carbon monoxide, the composition being ordinarily 32 per cent hydrogen, 48 per cent methane, 16.5 per cent acetylene, 3 per cent nitrogen, and 0.5 per cent oxygen. Theoretically such a gas on complete combustion should furnish a volume of hydrogen 60 per cent greater than its original volume.

A modification of the Rincker-Wolter method has been in operation for some time at Utrecht by the Hollandsche Residugas Maatschappij. It uses a large generator of iron with chamotte lining (chamotte is a fire brick or tile made of refractory clay and broken saggers). The generator is filled with coke, the oil residues are introduced from the top, and air is blown in from the bottom. The cycle of operations is as follows: (a) Hot-air blast, one and one-half to two minutes; (b) oil residues sprinkled on top of the coke, two to three minutes; (c) hydrogen driven out by steam, one-fourth minute; (d) blast, etc. The hydrocarbons employed consist of petroleum residues from Texas and Galicia, or water-gas tar, a by-product in the manufacture of carburetted water gas. The resultant gas contains 96 per cent hydrogen, with small amounts of carbon monoxide. Its total cost, including interest, amortization, etc., is 5 pfennigs per cubic meter (6 cents per pound). By passing this gas again through a generator filled with coke at a higher temperature a still purer grade is secured, containing 98.4 per cent hydrogen, 1.2 per cent nitrogen, and 0.4 per cent monoxide. This gas has a specific weight of 0.087. Portable generators are now supplied regularly for the production of this gas in different degrees of strength.

THE LACHMANN PROCESS.

In most of the processes outlined above the hydrogen secured is accompanied by varying amounts of nitrogen, which naturally do not affect its value for the synthesis of ammonia. W. Lachmann (German patent 238569) goes a step further. He proposes to produce the desired mixture of hydrogen and nitrogen in the proper proportions (3 to 1) from a mixture of air and steam (1 to 2.4). The current of such a mixture is first conducted over copper at the proper temperature, which removes atmospheric oxygen, and then over glowing iron to remove the combined oxygen present in the steam. The resultant gas is 75 per cent hydrogen, 25 per cent nitrogen. A current of reducing gas is passed in the reverse direction over the oxides of iron and copper to restore them to the metallic condition. The furnace for this process resembles a Hoffman brick kiln. It consists of a circle of compartments separated from each other by radiating walls. The method is ingenious, but involves no material economy of production over the separate preparation of the two gases.

OTHER METHODS OF PRODUCING HYDROGEN.

Other recent methods for the production of hydrogen need only a brief mention. They are designed more particularly to meet the demands of aeronautics, especially when a balloon gas is required at a distance from industrial centers. The Carbonium Co., at Friedrichshafen (headquarters of the Zeppelin manufacture and management of dirigible balloons), has a factory in which compressed acetylene, C_2H_2 , is decomposed by means of electricity into hydrogen and carbon. The latter is so finely divided that it commands its own market for use as a pigment, etc. Siemens and Halske (German patent 220486) treat calcium carbide at a high temperature with steam. The following reaction takes place:



The carbon dioxide is removed from the resultant gas with the aid of lime from preceding operations. The yield is excellent and the hydrogen very pure. W. Gerhardt (German patent 226453) passes steam through molten iron in a holder very similar to a Bessemer converter. The oxide of iron is reduced to metal as in the process of the Internationale Wasserstoff Aktien-Gesellschaft, page 33.

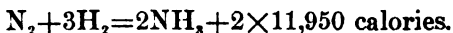
The Schuckert works generate the gas by the action of silicon on caustic-soda solutions. Their transportable equipment for this purpose is extensively employed by military aeronauts. Calcium hydride, CaH_2 , is also used to some limited extent on account of the ease with which it evolves hydrogen when treated with water. One kilo (2.2046 pounds) furnishes 1,100 liters (290 gallons). The hydrogenite of Mauriceau-Beaupré is used in a similar way. It consists of aluminum shavings mixed with a small amount of potassium cyanide and mercurous chloride. One kilo gives with water 1,300 liters (343 gallons) of hydrogen. G. F. Jaubert, of Paris (German patent 236974), manufactures hydrogen in the dry way by heating, in a cylindrical retort, mixtures of dry powdered hydroxides of the alkaline metals, or metals of the alkaline earths, with such reducers

as zinc, aluminum, carbon, silicon, or ferrosilicon. It is readily seen that these last-mentioned processes are entirely out of the question as sources of cheap hydrogen.

FUEL COST IN THE PRODUCTION OF AMMONIA.

From the foregoing it is evident that the materials for synthetic ammonia cost to-day only a comparatively small part of the value of the final product and that the plant need not be expensive or complicated.

The remaining item to consider is that of fuel. Direct data on this point are lacking. A small experimental plant, working continuously under a pressure of 185 atmospheres and at a temperature of 550° C., furnished ammonia at the rate of 2.16 kilos (4.76 pounds) per day of 24 hours. Uncertain factors are introduced by the time required for the reaction and the necessity of removing and cooling to a considerable extent the contents of the reaction chamber as soon as the volume of ammonia reaches 8 per cent in order to secure it in the liquid form or by absorption. It is not difficult to construct an extensive series of reaction chambers so that the loss of heat by radiation may be reduced to a very small amount per unit of time. Here comes into play, however, the actual length of time required for a given volume of the mixture of nitrogen and hydrogen to yield approximately the maximum percentage of ammonia or that percentage beyond which any slight additional formation of ammonia would not more than cover in value the loss of heat by continued radiation. As such an operation would be continuous, there need be no loss of heat in the reaction chambers other than that due to radiation after they have once been raised to the favorable temperature, 550° C. Loss by radiation is counterbalanced to some extent by the heat evolved in the reaction, which is exothermic, the contrary of that between nitrogen and oxygen:



When gaseous mixtures are withdrawn to the chamber for the removal of the ammonia formed it is possible to devise the apparatus so that a large share of the heat given off in cooling may be restored to the returning stream of the two gases before reentering the reaction chamber. The sum total of heat required would consist, then, of the following items: Motive power of compressor; heating the gaseous mixture to 550° C., less heat absorbed on cooling final product; loss by radiation from reaction chamber, less heat developed by the reaction; loss by radiation from cooling chamber and by alternate cooling and reheating of gases withdrawn from reaction chamber.

Unless the reaction is very slow, which would likewise have its effect on the item of interest on capital, it would appear that the total expenditure for fuel ought not to equal the cost of material. As has been shown there is a wide margin between the cost of the latter and the current value of ammonia.

Prof. Haber informs me that if the operation be so conducted that the heat of the gases withdrawn from the reaction chamber may be completely surrendered to the fresh charge of nitrogen and hydrogen, and if loss by radiation be totally prevented—conditions easily

attained in a small plant—the temperature in the reaction chamber quickly rises to a degree far above that at which chemical combination can be successfully and profitably secured. He is further quite confident that on a large scale the cost of fuel will be an insignificant factor that may be neglected.

AMMONIUM SULPHATE VERSUS CHILE SALTPETER.

It is probable that the owners of the Haber patents have it in their power to produce ammonia, and hence ammonia compounds, profitably at prices far below those which these substances now command in the world's markets. As ammonium sulphate, the dominant member of the group, is used almost exclusively as a fertilizer, and as ammonia is exclusively a by-product of the distillation and coking of coal, etc., its price is controlled almost entirely at present by that of Chile saltpeter and the world's demand for combined nitrogen. With any possible introduction on an unlimited scale of a new form or source of combined nitrogen, the production of Chile saltpeter would soon be largely abandoned. The production of ammonia from gas works and coke ovens would, however, continue indefinitely. Any lowering of the price would be compensated by minute additions to the prices of other by-products, such as tar, coke, and gas itself. Should very cheap synthetic ammonia be industrially feasible the price of ammonium sulphate might be brought down very rapidly to a rate that would force the closing of most of the Chilean factories, and there it would remain until the expiration of the patent rights.

OTHER METHODS OF MAKING SYNTHETIC AMMONIA.

TWO FRENCH PATENTS.

A method for the synthetic production of ammonia has recently been patented in France by Brochet and Boiteau (French patent 425952; 1910). They claim to be able to obtain the compound by using as catalytic agents calcium or the allied metals, barium and strontium, and also the carbides, nitrides, and cyanides of these metals. Nitrogen and hydrogen are passed over such contact substances at temperatures ranging from 250° to 750° C. An earlier French method, patented by the Société l'Azote (German patent 17070), is based upon the use of spongy iron and titanium, or platinumized carbon, as catalytic substances.

AN AMERICAN METHOD.

Mention should also be made of the method proposed by H. S. Blackmore (American patents 974633, 974741, and 974742) for effecting the synthesis of ammonia from its constituent elements. The hydrogen and nitrogen, previously heated, are driven through mercury contained in a slightly inclined revolving cylinder. The operation is favored by passing an electric current through the mercury, with the resultant series of sparks between drops of the metal. Calcium or palladium are also added to the mercury to heighten the catalytic action, and the liquid is forced into the reaction chamber through small openings. Details are lacking as to the technical value of the process.

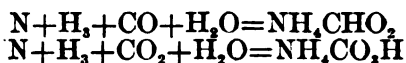
NITBACK'S PATENT—AMMONIA FROM DOWSON GAS.

Nitback (German patent 95532) electrolyzes water saturated with nitrogen under a constant pressure of 50 to 100 atmospheres. The electrodes are separated from each other by a diaphragm. The nascent hydrogen liberated about the cathode combines with the nitrogen to form ammonia. The solution thus collected in the cathode cell, when sufficiently strong, is drawn off, and the ammonia water used as such or changed into salts. Oxygen is liberated at the anode. As the ammonia diffuses to some extent there is a partial oxidation to ammonium nitrate about the anode.

A few other proposed means of effecting an industrial synthesis of ammonia may be added. Schlutius (English patent 2200; 1903) makes use of the well-known "Dowson" gas, obtained by passing air and steam simultaneously over glowing coke. The average composition by volume is hydrogen 15 per cent, carbon monoxide 30 per cent, carbon dioxide 5 per cent, nitrogen 50 per cent. When this gas is mixed with steam and exposed to the action of electric discharges, ammonia is formed at temperatures below 83° C.; above that temperature ammonium formate, NH_4CHO_2 , is produced. Naturally the process is applicable to mixtures of steam, nitrogen, and hydrogen. As Dowson gas costs less than a quarter of a cent per cubic meter, it furnishes a convenient and economical material for the purpose. Freed from the carbon compound by any of the methods noted above and enriched with the necessary amount of additional hydrogen, it could also serve as raw material for the Haber synthesis.

P. R. DE LAMBILLY'S METHOD.

P. R. de Lambilly (German patents 74274 and 78573) has found that ammonium formate and ammonium bicarbonate, $\text{NH}_4\text{CO}_2\text{H}$, can be obtained when mixtures of the two elementary gases with steam and either of the oxides of carbon are exposed to the action of catalytic agents, thus—



The favoring temperature for the formation of bicarbonate ranges between 40° and 60° C., and that for the formation of formate between 80° and 130° C.

As these reactions do not involve the use of high temperatures, and as cheap industrial gases can be employed economically, with the addition of more or less hydrogen, and as solid and easily soluble ammonium salts are the direct product, it would seem advisable to take up their study again and test their technical efficiency under pressure or with uranium as the contact substance.

FEAT AS A CATALYTIC AGENT.

The various early attempts to effect the direct union of hydrogen and nitrogen with the aid of the electric spark do not seem to have led to any practical result. The claims of H. C. Woltereck (German patent 146712; 1902), Ireland, and Sugden (German patents 175401, 176616, and 180141) to produce ammonia by conducting

air and steam over peat at a high temperature, the peat acting as a catalytic agent, have attracted considerable attention during the past few years, and capital has been enlisted on their behalf. J. C. Jones and P. Suarez (German patents 220670 and 234793) have likewise published methods of a similar nature. The German chemist N. Caro, a leading authority in everything connected with the utilization of atmospheric nitrogen, has now shown conclusively by an exhaustive series of experiments (*Chemiker Zeitung*, 1911, p. 505) that no more ammonia can be secured by this method than that corresponding to the combined nitrogen in the peat. His own process for utilizing peat for ammonia will be noted later.

METHODS OF REDUCING OXIDE OF NITROGEN.

There are a number of patented methods for producing ammonia from the oxides of nitrogen by reduction with hydrogen, water gas, or hydrocarbons. They possess no industrial value for the time being, as nitrogen in combination with oxygen possesses a higher value than when in the form of ammonia. Should the conditions ever be reversed these methods may become of interest. An excellent means for accomplishing such reductions of nitric and nitrous compounds is presented in the method lately devised by the Elektrochemische Werke G. m. b. H., of Berlin (German patent 238137) in which a careful adaptation of temperature to contact agents assures satisfactory yields from mixtures of the oxides of nitrogen with hydrogen, illuminating gas, or water gas. Thus nitric oxide, by use of a contact substance containing 1 per cent of platinum, is entirely reduced to ammonia at 650° C. A similar complete reduction is effected by the use of contact material containing 4 per cent nickel or copper at 750°.

OXIDATION OF AMMONIA TO NITRIC ACID.

Of greater importance are the means provided for oxidizing ammonia and using it as a source of nitric acid, nitrates, nitrites, etc. For agricultural purposes ammonium compounds can always be used advantageously without further change, although in Europe nitrogen in the form of ammonium salts is considered to average only nine-tenths the effective value as a fertilizer that it possesses in the form of a nitrate. A still lower value, viz, 70 per cent, is assigned to ammonia nitrogen by American chemists. (Cf. Vorhees, *Jour. Ind. and Eng. Chem.*, 1910, p. 155.) For some few crops the ammonium compounds seem to possess distinct advantages over the nitrates. In the preparation of mixed fertilizers containing superphosphates, ammonium sulphate is usually preferred to Chile saltpeter. When use is made of the latter some nitric acid is liberated and lost, sacks are attacked, and spontaneous combustion sometimes occurs. In the arts, however, there is a large and increasing demand for nitric acid and the nitrates and nitrites, which absorbs one-fifth of the entire annual product of Chile saltpeter. Should the present supply of the latter be exhausted, and should it eventually be found that the great reserve stock of nitrogen can much more economically be changed into ammonia than it can undergo oxidation and be transferred into the

nitric condition, then practical methods for oxidizing the cheaper compound will be of the greatest value.

PROF. OSTWALD'S INVENTION.

This problem has been solved in an exceedingly simple manner by the distinguished German chemist, Prof. W. Ostwald, of Leipzig, with the aid of Dr. E. Brauer. The process is protected by several foreign patents (French patent 317544; Swiss patent 25881; English patent 698, of 1902), but could not be covered by a patent in the inventor's own country on account of prior publication of the essential features, as scientific facts, many years ago.

As early as 1839 F. Kuhlmann found that when mixtures of air and ammonia were conducted through tubes containing platinum sponge or finely divided copper and nickel, at temperatures slightly above 300° C., nitric and nitrous acid were formed. Warren, in 1891, obtained ammonium nitrite when ammonia and oxygen were passed over platinized asbestos at a dull-red heat. Marston, in 1900, secured nitric compounds by passing the gaseous mixtures over hot copper and similar contact substances. Other chemists have noted the readiness of ammonia to undergo oxidation when brought in contact with ozone. The facility with which bacterial organisms in the soil change ammonia to nitrous and nitric acid has already been noted.

Ostwald investigated very thoroughly the conditions favorable for the reaction, and combined them so as to constitute a successful technical process. The most effective catalytic reagents he found to be the members of the platinum group of metals, and the higher oxides of manganese, lead, copper, silver, iron, cobalt, and nickel. The best results were secured by the use of a compact sheet of platinum, with a roughened surface partly covered by spongy platinum; in fact, such a physical condition as is produced when a smooth sheet has been used some time for the purpose. While platinum sponge gives the best yield in the sulphuric-acid contact method, it induces too rapid a reaction in the case of nitric acid, and a less energetic catalytic agent is preferable.

SIMPLICITY OF APPARATUS.

The apparatus is exceedingly simple in construction. The mixture of air and ammonia obtained by sucking air through the ammonia water of gas works, to which lime has been added, enters at one extremity of a wide tube. It finds its exit through a narrower tube, open at the other extremity of the wider inclosing tube, extending through the entire length of the latter, in an axial line, and terminating in an absorption chamber. The catalytic material is placed in the inner tube. This arrangement, that of the reverse current, enables the air-ammonia mixture to regulate automatically the temperature of the reaction, and prevent it from becoming too violent. The air current is sucked through ammonia solutions of constantly increasing strength, so as gradually to exhaust them, and the heat of the reaction is transferred to these solutions. The temperature is kept at a dull-red heat.

The construction is thus comparatively simple. The controlling factor is the rapidity of the gas current, which must be so regulated as to avoid, on the one hand, too long contact with the catalytic substance and a consequent formation of nitrogen and water, and on the other, an insufficient opportunity for nearly all of the ammonia present to participate in the reaction. Thus far it has not been possible to oxidize more than 85 per cent of the ammonia to nitrous and nitric oxides. Ostwald has found it advantageous to regulate the operation so that only one-half of the ammonia should be converted into nitric acid, and that this should combine with the remaining half to form ammonium nitrate, NH_4NO_3 . This salt is admirably adapted for use as a fertilizer. It contains 35 per cent of nitrogen (ammonium sulphate, 20 to 21 per cent; Chile saltpeter, 15.5 per cent), and hence there is a notable economy involved in its transportation. Further, no sulphuric acid is needed for its manufacture. It is hygroscopic, and must be protected from exposure to air. At present it is employed for a variety of minor chemical operations, such as the preparation of laughing gas. The chief demand, however, is for use in the manufacture of safety explosives. In this form, for the time being, there is a large field for the extension of the Ostwald process. If it is found most economical to limit the contact process to the production of this salt, it is not difficult to regenerate the ammonia present by treatment with lime, and from the resultant calcium nitrate to liberate the nitric acid by treatment with sulphuric acid.

FACTORY AT GERTE, WESTPHALIA.

The inventor, instead of hastening to exploit the process on a large scale, has taken time to perfect all the details. In 1909 a factory was equipped at Gerte, near Bochum, in Westphalia, for producing annually 2,400 tons of nitric acid (53 per cent HNO_3). The operation of this factory has been highly successful. A considerable amount of ammonium nitrate has been manufactured during the past three years. The process was purchased by the Nitrate Products Co. (Ltd.), 308 Winchester House, Old Broad Street, London, and this company has conducted the manufacture in Gerte in 1911 and is building a second factory in Belgium. There is every indication that the Ostwald process is to be reckoned with as a competing factor in the industrial production of nitric acid. It has no bearing on the general nitrogen problem, as it involves nothing more than the change of combined nitrogen from one form of combination to another. On account of the absence of patent protection in Germany great secrecy is maintained with regard to the details of the process.

CRITICISM OF OSTWALD'S PROCESS.

Ostwald's method has been subjected to criticism by O. Schmidt, who claims, on the basis of laboratory experiments, that it can not be operated with success financially. In his experiments, conducted at dull-red heat in small tubes, platinized asbestos and platinum spirals were used as catalytic agents. His average yield was 75 per cent

of the ammonia present, but sometimes reached 80 per cent or more. The first product was nitric oxide, NO. This anhydride formed 80 to 90 per cent of the total yield, the remainder being nitric acid. It is doubtful whether Schmidt's criticism is based upon an adequate experimental basis.

VARIOUS OXIDES AS CATALYTIC AGENTS.

Shortly after the announcement of Ostwald's invention, Fr. Baeyer & Co., of Elberfeld (German patent 168272), brought out a similar contact method in which the oxides of the heavier metals, cupric oxide, ferric oxide, etc., were employed as catalytic agents. A current of air mixed with 4 to 5 per cent of ammonia gave the best results, and temperatures ranged from 600° to 750° C. Above 650° the yield was exclusively nitrous anhydride, which was absorbed in alkaline solutions after the gases were sufficiently cooled. So far as can be ascertained this process has not been put in operation on an industrial scale. Frank and Caro (German patent 224329) propose the use of cerium and similar oxides as contact substances, but more especially thoria, which, they claim, gives the highest yield in oxidizing ammonia. The value of thoria for this purpose is due to the fact that when formed from thorium nitrate the mass puffs up to such a degree that an unusually large surface is available. The other oxides tend to cake and form compact masses.

It appears that the air current issuing from the Ostwald apparatus, deprived already to a large extent of its oxygen, might serve admirably for use in any process aiming to prepare pure nitrogen, for the manufacture of cyanamide, the technical synthesis of ammonia, etc.

UTILIZING THE ACTION OF NITRIFYING BACTERIA.

Apart from these more purely chemical processes for the oxidation of ammonia, it is well to bear in mind that there is a possibility of utilizing on an industrial scale the action of the nitrifying bacteria which transform in the soil the ammoniacal products of organic decomposition. Peat offers peculiarly favorable conditions for their activity. The French investigators A. Müntz and E. Lainé succeeded in 1906 in securing results that might well form the basis for a manufacturing plant should the relative prices of ammonium compounds and nitrates ever be favorable. They added to peat a sufficient amount of lime to combine with the acids liberated, and then let a solution of ammonium sulphate (75 per cent) drain through the porous mass. As collected beneath, it was a 1 per cent solution of calcium nitrate, showing that the oxidation was practically complete. By this method 1 cubic meter of peat yielded 6.5 kilos of calcium nitrate in 24 hours (1 cubic yard would yield 11 pounds). In the eighteenth-century "saltpeter plantations" of northern Europe 1 cubic meter of earth yielded 5 kilos of crude saltpeter in two years.

The French chemists found that dilute solutions of ammonium salts alone were susceptible of quick nitrification. Obviously 1 per cent solutions of nitrate are not technically profitable, owing to the cost of evaporation. The presence, however, of considerable amounts of nitrates in the solution to be oxidized does not affect the activity of the bacteria. A 1 per cent solution of nitrate can therefore receive

a further normal addition of ammonium sulphate, pass again through the thick bed of peat, and become a 2 per cent solution. This treatment can be repeated until the most advantageous strength for evaporation is attained, as controlled by local costs of fuel. Müntz and Lainé easily secured solutions containing 22 per cent of nitrate. The utilization of this interesting discovery is dependent on conditions of temperature. The favorable temperature for the activity of the nitrifying bacteria is 30° C., and variations should be as slight as possible. In tropical or semitropical lands the prevailing temperature can be controlled for the purpose without much cost. In temperate regions a certain outlay for fuel will be necessary, varying according to the season of the year.

There is certainly much promise in this extension of the activity of nitrifying bacteria from the soil to the field of chemical manufacture. M. Reich, in an Austrian patent of 1907, proposed to use the above method for utilizing the ammonia in the mother liquors of the ammonia-soda process.

Nitback's method, already mentioned, effects the synthesis of ammonia by electrolytic action, the nascent hydrogen being generated in a solution charged with nitrogen under pressure. There would seem to be a possibility of combining here the production of ammonia and its oxidation to ammonium nitrate. By the use of a diaphragm the anode could be located in a cell containing the ammonia solution withdrawn from the cathode, likewise maintained under pressure. The nascent oxygen as fast as evolved could act directly upon the ammonia and produce a solution of ammonium nitrate.

SYNTHESIS OF NITRIC ACID FROM ATMOSPHERIC NITROGEN AND OXYGEN.

While the technical synthesis of ammonia is still in its infancy, that of nitric acid as a product of the direct combustion of the two chief constituents of the air has been recognized as a distinct branch of chemical industry.

One of the most interesting chapters in the history of science is offered by the long sequence of observation and experiment, which covers nearly a century and a quarter, and out of which has been evolved the present successful technical process.

EARLY DEVELOPMENT.

In 1781 Cavendish noted the formation of nitric acid when hydrogen was burned in the air, and in 1784 he published his experiments. In 1785 he found that when electric sparks passed through a confined volume of air an acid was formed and a diminution of the volume occurred. It remained for Bunsen, in 1857, to explain fully the results.

In 1798 L. Odier recognized the formation of nitric acid in the air as really an act of combustion due to heat, but was unable to obtain the requisite temperature by external heating. Sir Humphry Davy, 1800, passed air over a platinum wire heated by electric current, and noted the formation of nitric oxide. The catalytic action of platinum was then unknown. Not until 1864 did Gay-Lussac demonstrate this property of the metal by experiments on nitric oxide; he thus opened the way for numerous syntheses.

Two important facts were thus established. The nitrogen of the air could be oxidized by the aid of high temperatures, furnished by the use of the electric current, or by inner explosion. A. Perrot, in 1861, recorded other favorable conditions—lengthy discharges with the induction coil (first used on air by Böttger in 1858) gave better results than short ones, and the air should be kept in movement. In 1870 Berthelot showed that the electric arc gave results identical with those furnished by the electric spark, the only difference being in the increased intensity of the reaction, due to the more powerful arc. At the same time he discovered the fact that in a confined volume of air a limit to the oxidation was soon reached, i. e., a degree of concentration of the oxides of nitrogen was attained beyond which dissociation of the newly formed molecules into nitrogen and oxygen took place as rapidly as the combination of the two elements. (A similar limit has been noted in the synthesis of ammonia.) Crookes's experiments in 1892, and the still more accurate ones of Lord Rayleigh in 1897, showed very distinctly the identity of the results obtained with the electric spark and with the arc, and the advantage of employing arcs of high tension, supplied by powerful currents, especially when an excess of oxygen was added to the air.

With the perfection of the electric dynamo, and the discovery by Pflücker, in 1861, of the enlargement of a stream of electric sparks to a disk when passing through a magnetic field, all of the essential facts and material accessories were available for a technical development of the reaction.

The first recorded attempt at an industrial utilization was made by a woman, Madame Lefebvre, of Paris, who in 1859 secured an English patent for the manufacture of nitric acid with the aid of electric discharges. An English apparatus by Newton, described in 1859, was possibly constructed under this patent. A number of platinum wires were arranged in a confined space so as to allow the passage of electric sparks between their extremities. Provision was made for absorption by water of the acid produced, and for renewing the supply of air. Apparently success was not attained by this pioneer, nor by G. Prim, of Mons, whose German patent described a process for manufacturing nitrous acid from the air by the simultaneous use of electric sparks from an induction coil and of the silent discharge between condenser plates. A dynamo was used as the source of electric energy. Siemens and Halske in 1894 patented a method of using the silent discharge for changing the oxygen of the air into nitric acid and combining it directly with ammonia to form ammonium nitrate.

In the patent of Naville, Guye, and Guye of 1895 (German patent 88320; French patent 253192, 1896; and addition, 1897), is encountered the first decided approach toward the more successful processes of recent date. The Swiss inventors made use of a current of sparks between carbon electrodes and established several principles, as follows: In order to secure the highest yields, it is necessary (1) to withdraw the gaseous mixture as rapidly as possible from the action of the electric discharge before reaching the limit of formation of nitric oxide; (2) to renew constantly and rapidly the gas submitted to the reaction; (3) to use a reaction chamber as small as possible in comparison with the space occupied by the electric discharge, so that the entire mass of gas may be exposed to the high temperature produced by the discharge.

In 1896 Bonna, Le Roger, and Von Berchem (German patent 93592), in experiments at Geneva, were the first to replace the induction spark by the electric arc and to lengthen it by the use of a spiral electrode. MacDougal and Howles (English patent 4643; 1899) erected a small plant in which eight arcs of 5 centimeters each were arranged in a row, and the alternating current of a dynamo of 7,500 volts and 50 cycles was used. It produced from air 34 grams of nitric acid per kilowatt hour, and double that amount from a mixture of 1 part nitrogen and 2 parts oxygen. Many mechanical difficulties were encountered, and an industrial plant was not attempted. Serious losses of electric energy in the conductors, as well as an extensive dissociation on the edge of the flame, due to the slow removal of the gas from the reaction region, rendered the operation impracticable from a commercial standpoint.

During the closing years of the last century Veith, Hempel, and Berthelot made valuable contributions to our knowledge of the reaction, affected by pressure and temperature.

BRADLEY AND LOVEJOY METHOD.

With the beginning of the present century the time seemed ripe for the application on an industrial scale of the combined result of experiments and theory in the oxidation of atmospheric nitrogen. The first manufacturing plant was erected on American soil. While not a commercial success the method used was of great technical interest and served to guide European inventors to the rapid perfection of more successful devices. In 1901 C. S. Bradley and R. Lovejoy patented their processes and the necessary mechanical devices for manufacturing nitric acid from the air, based upon the principle of creating an enormous number of small, slender electric arcs of brief duration; so that a limited amount of electrical energy can present a large total surface of flame. (English patent 8230, American patents 709867 and 709869, Swiss patent 24229.) The Atmospheric Products Co., a corporation organized with a capital of \$1,000,000, took over the patents and in 1902 erected large works at Niagara Falls.

The apparatus used consisted of iron cylinders 5 feet in length and 4 feet in diameter, revolving upon axes. Each axis was equipped with a number of projecting arms with platinum points. These arms were arranged in 23 successive series of 6 each. A corresponding series of similar arms projected from the inner surface of the inclosing cylinder. The cylinder formed one electrode of a powerful electric current, its axis another. When the cylinder is kept in active rotation its set of platinum terminals passes rapidly, at a short distance, past the corresponding inner set. If the electric current is turned on, sparks constantly pass between opposite points, and these sparks, in consequence of the rotation, are prolonged in length until the distance between the points becomes too great. There is thus a constant formation, prolongation, and interruption of electric sparks. When a direct current of 10,000 volts was used in the Niagara Falls works it meant the formation and cessation in each cylinder of 414,000 individual electric arcs per minute. A current of air forced through such a cylinder is in constant contact with a multitude of electric arcs, characterized by a maximum of length and a minimum of cross section. The result is rapid heating and equally rapid cooling of the air. It was claimed at that time that 3 per cent of the nitrogen in an air current, under the described conditions, was oxidized to nitric oxide. A careful estimate showed that the normal yield of nitric acid was 948 pounds per kilowatt year of electrical power employed. This yield proved insufficient to render the enterprise commercially successful, as the mechanical equipment was costly and required frequent repairs. The works were in consequence closed in 1904.

Bradley and Lovejoy demonstrated conclusively the advantages of expanding the electric flame over large surfaces by the employment of long, slender arcs, and the importance of bringing every portion of the air current for an instant in contact with an arc.

BIRKELAND AND EYDE PROCESS.**RAPID EVOLUTION OF THE APPARATUS.**

While the works at Niagara Falls were still in operation Christian Birkeland, professor of physics in the University of Christiania, and Samuel Eyde, a Norwegian engineer, elaborated the details of a simple and novel method that was destined to be the first industrially successful process for transforming the air into a commercial product. The long list of their patents begins with the Norwegian patents 13240 and 13280, of 1902; the English patent 20003, of 1904; the American patents 772862, of 1903, and 775123, of 1904; and the German patents 170585, 179825, 179882, and 188231, of 1904. Early in 1903 experiments were made with a furnace using a current of 3 horsepower. In October, 1903, a small factory plant, with 150 horsepower, was in operation at Ankerløkken, near Christiania. A year later a plant using 1,000 horsepower was opened near Arendal. In 1905 the works at Notodden were in operation with 2,500 horsepower. These were enlarged in 1907 so as to utilize 40,000 horsepower and employ 150 workmen. In 1911, 55,000 horsepower was in use, and over 400 workmen were employed. The plant in all its varied phases is a marvelous example of the rapid evolution of a chemical process from small beginnings.

THE ELECTRIC DISK.

The essential feature in this process is the technical utilization of the phenomenon discovered in 1861 by Pflücker, that an electric arc when placed between the poles of an electromagnet expands so as to form a thin disk of flame. While to the eye such a disk seems continuous, it is as a matter of fact in a state of the greatest mobility. The actual sequence of phenomena, as shown by Solomon and Lehmann in 1898, in experimenting with currents of high power, is as follows: When an arc is formed between electrodes located in an electromagnetic field, the power exerted by the latter forces the arc to leave the direct path between the terminals and to assume a curved form. The curve is pressed outward, its starting points retreating from the ends of both electrodes until the length is such that the limit of resistance is reached. The arc breaks, as it were, and disappears, being replaced simultaneously by a new arc in a direct line between the electrodes. This arc undergoes the same experiences. The peculiar force developed in the electromagnetic field tends, apparently, to blow out the electric flame, and the phenomenon has been termed the electromagnetic blast. The formation, expansion, and disappearance of an arc may take place as frequently as 1,000 times in the course of a second. The rapidity is controlled by altering the power of the electromagnet. For the technical purposes in question about 100 transformations per second suffice. The eye sees simply a thin disk of flame at right angles to the line joining the poles of the electromagnet. As the arc in expanding moves more rapidly outward along the negative electrode than along the positive, the center of the flame is diverted slightly to one side. If the electromagnet be fed by a direct current and a direct current passes through the electrodes, the flame presents the form of a half circle. With an alternating current serving the electromagnet and a direct

current passing through the electrodes, arcs expand in both directions, and a sheet of flame approximately circular in form is produced. The same result follows the use of an alternating current in the electrode and a direct current in the magnet.

The use of such an electric disk for effecting the combination of oxygen and nitrogen marked a decided advance forward in the evolution of the general process, and made it possible to start the new industry on a satisfactory economic basis. Combined with great simplicity in mechanical detail, the relatively great surface and extreme tenuity of the electric disk rendered it possible to bring large volumes of air in contact with the intensely hot flame, and to cool the resultant products with remarkable rapidity.

THE WORKS AT NOTODDEN.

The works at Notodden were formerly equipped with 32 furnaces, each of 300 to 1,000 kilowatt capacity. A complete division of 4,000-kilowatt furnaces has recently been put in and furnaces of 6,000 kilowatts are in contemplation.

The individual furnace may be described as a low, wide cylinder resting upon its side and placed between the arms of an enormous horseshoe magnet. The cylinder is made of heavy iron plate and consists of similar halves, which are bolted together. The interior is lined with refractory brick, so arranged that in the middle there is a narrow, circular chamber, over 2 meters (6.56 feet) in diameter, and 10 centimeters (3.937 inches) in width. In this circumscribed space the reaction takes place. The huge terminal poles of the wrought-iron electromagnet, beveled at the extremes, are embedded in the chamotte lining, and are about 25 centimeters (9.84

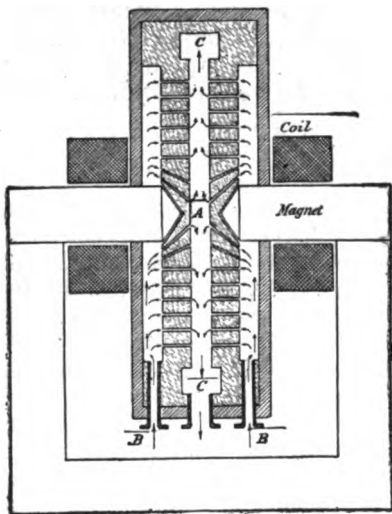


FIG. 1.—Birkeland and Eyde furnace, later type: A, reaction chamber; B, entrance of air current; C, exit of gases.

inches) apart, their axis corresponding with that of the chamber. The electrodes are of copper, with internal circulation of water, and are 1.5 centimeters (0.59 inch) in diameter. They enter the chamber from opposite sides, and are separated from each other at its center by an interval of 8 millimeters (0.31496 inch). Air under pressure, is admitted to passages between the external shell and the chamotte lining, and enters through numerous small inlets in the latter, into the reaction chamber. The gaseous current issues, through openings in the periphery of the chamber, into a conduit which leads to the absorption apparatus. A small window of mica in the front of the furnace allows inspection of the operation. A direct current feeds the coils of the big magnet located immediately outside the iron shell, and an alternating current is connected with the electrodes. This current is one of 5,000 volts, 50 cycles in the second.

The most striking features of such a furnace are its simplicity and its durability. There are no movable parts; when in uninterrupted operation the electrodes are changed every three or four weeks, while the refractory lining is removed once or twice a year. Repairs are hence easy to make and the cost slight. A series of such furnaces may be kept in operation for weeks without special regulation and reveal exceedingly slight variations in energy.

LITTLE LABOR REQUIRED—THE FURNACE.

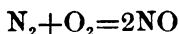
The visitor in the nitrate works is impressed by the slight amount of manual labor required at this stage of the process. In the large furnace room at Notodden, where 32 furnaces are in operation, only two or three workmen are visible, one of these being stationed at the switchboard, which is of imposing proportions and of unusually complicated construction. Swiftly revolving ventilators direct a volume of over 35,000 cubic feet of air per minute into the series of furnaces, from which a sharp rattling sound issues, due to the continuous breaking of arcs. A glance through the window of a furnace reveals the intensity of the reaction going on, at a temperature of over 3,000° C. The result of the process is measured by the percentage of nitric oxide, NO, contained in the air issuing from the furnace.

A number of huge glass flasks are kept in constant use for testing the outgoing gas. The air is sucked from such a flask by a powerful pump. It is then connected by a tap with the gas current, and filled in an instant with a mixture of air and nitric oxide. A quick method of titration is used, and in a few minutes the percentage of nitric oxide is known. With the aid of this test, based upon a rapid transformation of the oxide to the form of nitric acid, the supervising engineers carry on an apparently never-ending series of experiments, with modifications of furnace construction, and with changes in the rapidity of the air current, or of the intensity of the electric current. In the earlier days the percentage of nitric oxide was 1; then it was raised to 1.5; now it is 2.

TRANSFORMATION OF NITRIC OXIDE.

While the economic value of the process depends so largely on the outcome of the furnace reaction, there is a secondary factor of considerable importance. This is the method used to isolate the nitric oxide from the large volume of gas issuing from the furnace and transform it into nitric acid in a more or less dilute solution in water, or into some one of the various nitrates or nitrites demanded by commerce.

Chemically the reaction in the furnace between the oxygen and the nitrogen of the air is represented by the equation

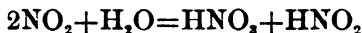


That is, one molecule of oxygen unites with one molecule of nitrogen to form two molecules of nitric oxide, a colorless gas.

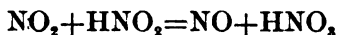
This nitric oxide unites readily with free oxygen, at temperatures below 620° C., to form nitrogen peroxide, a brown gas, with the formula NO₂, at temperatures above 140° C., and the formula N₂O₄,

at low temperatures. The peroxide condenses at 22° C. to a liquid, which at -30° C. congeals to a mass of colorless crystals. As the temperature falls from 140° C. the number of molecules of N_2O_4 in a given volume steadily increases, as shown by the increase in density and the change in color from a deep brown to a reddish brown, and then to a yellowish brown. At 60° C. half of the molecules in the gas are of the formula N_2O_4 . At 28° C. they constitute 80 per cent.

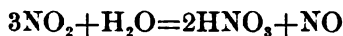
When the peroxide comes in contact with water it is dissolved and reacts, forming nitric acid and nitrous acid, thus:



With an excess of peroxide the nitrous acid is oxidized to nitric acid and nitric oxide is liberated, as follows:



The net result of these two reactions is that two-thirds of the nitrogen peroxide is transformed into nitric acid according to the equation



The liberated nitric oxide, in the presence of oxygen and water, repeats the cycle of changes given above, so that theoretically it is possible to change to nitric acid all the nitric oxide in the current of gas issuing from the nitrate furnace.

PRODUCTION OF NITROGEN PEROXIDE.

The actual process is not so simple as the equations indicate, and the plant required for the purpose constitutes the most imposing feature of nitrate works. The gases leaving the furnace at a temperature of about 750° C. enter into a huge main of iron lined with fire brick. Farther on the main is of aluminum, about 30 inches in diameter. This terminates at a large vat where the current of gas passes through a number of small tubes of aluminum, thus offering a large surface for cooling. Water can be heated in this vat or solutions can be evaporated. On leaving the vat the current is again concentrated in a single conduit, which leads to the steam chamber. Here the gas passes through tubular boilers and furnishes a large volume of steam, which can be used for evaporation or in the production of energy.

The gas possesses a temperature of about 200° C. on issuing from the boiler tubes. By passing through additional sets of aluminum cooling tubes the temperature is brought down to 50° C., and the current then enters two large chambers constructed of heavy iron plate, the walls being lined with material not affected by nitric acid. In these chambers the oxidization of the nitric oxide to nitrogen peroxide by means of the oxygen in the excess of air is completely effected. These chambers are of great capacity, so that the gases admitted remain in gentle movement for over a minute before reaching the outlet. This arrangement is rendered necessary by the fact that the oxidation requires some little time to be approximately complete. In a gaseous mixture containing 2 per cent of nitric oxide, 50 per cent of the latter is oxidized to peroxide in 12 seconds and 90 per cent in 100 seconds.

CHANGING NITROGEN PEROXIDE TO NITRIC ACID.

The product of the furnace reaction, transformed into nitrogen peroxide, is now ready to undergo the final change into nitric acid. For this purpose the contents of the oxidation chambers are directed by powerful ventilators into enormous absorption towers. These are built of Norwegian granite, are 20 meters (65.62 feet) high and 5.5 meters (18 feet) in diameter. The great granite slabs are 25 centimeters in thickness and are held in place by strong iron bands. A cement composed of asbestos and water glass is employed for the joints. The interior is filled with fragments of quartz, and the top of the tower is provided with the usual devices for distributing a liquid in the interior. At the bottom is an outlet leading to a montejus of earthenware. Connections are made with aluminum piping.

The systematic method of absorption is as follows: The current of gases is forced to pass through a series of three such towers, entering at the bottom, and issuing at the top. In each tower it encounters a descending current of more or less dilute nitric acid, trickling downward over the quartz masses and offering a vast surface of liquid for the absorption of the nitric vapors. The acid in the first tower is near the point of maximum concentration, i. e., 50 per cent of HNO_3 (34.70° Baumé), that of the second is much more dilute, and that of the third tower is very dilute. The current of gases in its course encounters successively masses of liquid of increasingly greater absorptive powers, while its percentage of NO_2 is rapidly lowered. By the use of compressed air the acid solution is forced from the bottom of a tower to the distributing reservoir on the top of the same tower, or of its neighbor; or, if fully concentrated, it is directed into large reservoirs of granite.

The contents of the first tower are passed repeatedly over the quartz filling until this maximum concentration is attained. Then either all or a part of the liquid is transferred to a storage reservoir and is replaced by a corresponding quantity from the second tower. A similar amount is contributed to the latter from a third tower, and in its place comes a supply of fresh water. In the second and third towers the solution is also forced to pass several times from top to bottom before the required strength is obtained. The cycle of reactions above enumerated is uninterruptedly in operation at all points in the series of towers. The practical result is that nitric acid, 50 per cent strong and free from nitrous acid, is continually withdrawn from the base of the first tower. In the other towers the solutions in movement contain increasingly large proportions of nitrous acid. An exceedingly ingenious automatic device is attached to each tower, controlling the action of the pumps and the movements of the absorbent solution. As in the furnace room, there is need of only a limited number of operatives in the group of towers.

METHODS OF PREVENTING WASTE.

As the percentage of peroxide in the air current decreases, the rate of absorption becomes more and more sluggish. When the air current issues from the third tower it still contains a certain amount of unabsorbed peroxide—sometimes as high as 20 per cent of the original quantity. In order to save as much as possible of this fraction

the stream of gas is passed through another large absorption tower, built of wood and lined with brick, in which water is replaced by a solution of sodium carbonate or by milk of lime. The rate of absorption is much more rapid here, and a mixed solution of nitrate and nitrite is obtained. From this last tower the current of gases is conducted through a chamber filled with fragments of quicklime, and finally issues into the air. It still contains from 2 to 2.5 per cent of the combined nitrogen yielded by the electric furnace, and at present this is lost. The mixed solution of nitrate and nitrite, when sufficiently concentrated, can be evaporated and used directly for fertilizing, or it can be changed into pure nitrate by treatment with an adequate amount of nitric acid, the liberated nitrous vapors being directed into the absorption towers. Various modifications in the disposition and use of the final absorption in alkaline solutions will be noted later.

A multitude of minor details, such as the clever automatic device for regulating the movement of liquids in the absorption towers, the use of aluminum connections, etc., all testify to the intelligent manner in which the Norwegian engineers have overcome the manifold technical difficulties in the way of transforming the nitric oxide supplied by the furnaces into nitric acid and nitrates.

COMMERCIAL PRODUCTS—NITRIC ACID.

The absorption towers yield chiefly 50 per cent nitric acid and secondarily calcium nitrate or other alkaline nitrates, as desired. The commercial products thus brought upon the market by the Notodden works are nitric acid in varying degrees of concentration, calcium nitrate, sodium nitrite, ammonium nitrate, and such small amounts of other nitrates as the local industries of Norway require.

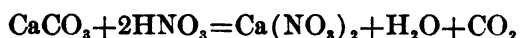
Concentrated nitric acid is manufactured to some extent at Notodden by evaporation of the 50 per cent acid secured from the towers. The steam secured in cooling the hot gas current is used for the purpose of heating the distillation vessels. On account of the difficulties attending the transportation of this acid, no attempt is made to give it prominence in the general scheme of manufacture, or to do more than supply a purely local demand.

CALCIUM NITRATE.¹

The production of calcium nitrate is a feature of the Norwegian nitrate industry and will evidently remain so as long as the chief aim is to produce a fertilizer capable of replacing Chile saltpeter. The manufacture at Notodden is exceedingly simple. The nitric acid yielded by the towers is neutralized in large granite vats by the addition of ordinary limestone (calcium carbonate), quantities of

¹ The British acting consul at Christiania reports, on the authority of the local press, the production of a new artificial manure, "biphosphate," as a result of experiments at the Notodden Nitrate Works. The new fertilizer is a by-product of the nitrate of lime produced at these works and is obtained without affecting the quantity of nitrate produced. Apatite or other raw materials are dissolved in the nitric acid and are then submitted to further treatment. The experiments have been carried out with apatite from the Bamle apatite mines. It is stated that the "biphosphate" should prove very valuable as an artificial manure for replacing both the superphosphate hitherto in use and Thomas phosphate. It is added that it will probably be possible to place this manure on the market at a low price.—British Board of Trade Journal.

which in a very pure form are found in this section of Norway. The current price is \$0.50 to \$0.80 per ton. The reaction is accompanied by the evolution of vast masses of carbon dioxide, which, thus far, are not utilized:



The resultant solution, to which is added the solution obtained in the lime absorption tower, is evaporated in iron vats by the aid of the steam furnished at the earlier stage of the process, until the temperature of 145° C. is reached. There is then in the solution about 80 per cent of anhydrous $\text{Ca}(\text{NO}_3)_2$, and less water than corresponds to the composition of the crystallized calcium nitrate, $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$. The contents of the vats are poured directly into sheet-iron cylinders and allowed to solidify, if the product is to be supplied for use in the arts. On account of the hygroscopic nature of this salt, the covers of the containers are soldered on hermetically. The substance contains 13.5 per cent of nitrogen. If the crystallized salt, with four molecules of water, is desired the evaporation is stopped at 120° C., and the solution allowed to crystallize. The crystals thus obtained contain 11.86 per cent of nitrogen and are of remarkable purity. They are dried in a centrifugal and packed in air-tight containers. The product is now used extensively for the preparation of barium nitrate, so largely used in the manufacture of fireworks and barium peroxide.

NONHYGROSCOPIC NITRATE.

At the outset the 13.5 per cent product was supplied for use as a fertilizer. Its pronounced hygroscopic nature, however, soon made it evident that in this form its future was beset with difficulties. Many attempts were made to avoid this obstacle. Gypsum, earths, even shavings and other materials, were mixed with the salt. It was also formed into bricks under very high pressure. Finally, the problem was solved in a very simple manner. The evaporation of the nitrate solution was carried so far that over 50 per cent of the normal water of crystallization was driven off. To this fused mass a certain amount of slaked lime in the form of fine powder is added and thoroughly incorporated.

The resultant mass, a basic nitrate—or essentially a mixture of the partly dehydrated normal salt with the basic nitrate, $\text{CaNO}_3 \cdot (\text{OH})$ —is but slightly hygroscopic and is well adapted for use as a fertilizer. It contains 13 per cent of nitrogen. The exact analysis shows: N_2O_5 , 50.21 per cent; CaO , 25.94 per cent; H_2O , 23.60 per cent; SiO_2 , 0.25 per cent. The solidified masses are broken into fragments, ground finely, passed through a sieve, and then packed in tightly made barrels of wood, each containing 100 kilos (220 pounds). In this form the nitrate is delivered to the trade. In Germany it is termed *Norge Salpeter* or *Kalksalpeter*; in France, *nitrate de Norvège*; in England, *nitro-lime*.

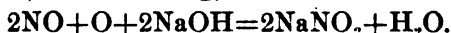
SODIUM NITRITE.

In the manufacture of coal-tar colors sodium nitrite is of considerable importance for the production of diazo compounds. Hitherto it has been made by fusing metallic lead, at 450° C., with sodium nitrate.

It is obvious from the description given that the air-nitrate process offers an excellent opportunity for the cheap manufacture of this salt. The gas current from the third absorption tower in a series, as previously described, contains a mixture of nitric oxide and nitric peroxide. Instead of being conducted into the lime tower it is passed into a boiling solution of caustic soda, thus yielding a solution of nearly pure sodium nitrite. This is concentrated by evaporation in open vessels and allowed to crystallize. The crystals are dried in a centrifugal. The reaction is as follows:



The same result may be secured by conducting the current of gas from the furnaces, before cooling, into the caustic alkali, thus:



The Norwegian Co. has patented this process (English patent 28613; 1904). In 1910 the company exported 3,200 tons of this nitrite, chiefly to Germany, where the annual consumption is about 5,000 tons. While the world's consumption of the salt is not great, it is steadily increasing, and this new and economical source is welcome. The present demand can be met by an annual expenditure of about 12,000 horsepower of electrical energy.

AMMONIUM NITRATE.

Ammonium nitrate is used on a large scale in the manufacture of safety explosives and the demand is rapidly increasing. As already noted, the Ostwald process of manufacturing nitric acid from ammonia can be used with advantage in the production of this salt. During the past year it has been found at Notodden that the nitric acid produced could be used with much greater profit in manufacturing ammonium nitrate than in competing with Chile saltpeter. At the time of my visit nearly all of the acid produced was utilized in this way. Norway produces but little ammonia, and hence the large quantities of 29 per cent ammonia water needed for the purpose are brought directly from England by water. The entire product is likewise shipped to England. This new branch of manufacture must be a paying one as the dilute nitric acid, the first and least expensive product of the works, competes advantageously with the comparatively expensive nitric acid employed in other lands in the preparation of the ammonium salt. Cheap freights by water are an important factor in this case.

This is one of the few chemical processes in which there are practically no losses or by-products. The nitric acid, which is conducted about the works in aluminum pipes, is added slowly to large volumes of ammonia water inclosed in a large, tightly covered vessel of iron, which is provided with an agitator and a refrigerating coil, as well as with a special draft.

The addition of the acid ceases before all of the ammonia is saturated, so that the resultant solution has a slightly alkaline reaction. It is then run through a filter press and passes into vacuum chambers, where by means of steam coils evaporation is carried on under a pressure of 20 millimeters of mercury. The hot solution, in which but little water is present, is directed into long crystallizing troughs,

slightly inclined, and subjected to a continual rocking motion. The arrangement is such that the salt gradually separates in the form of small crystals, with no inclosure of mother liquor. The mother liquors are drained off in a special chamber, and the white salt is further freed by treatment in a centrifugal.

Final drying takes place in a special chamber of recent and novel construction, which will be described later. The dried salt, which has a purity of 99.99 per cent, is discharged into barrels lined with strong paper. Each barrel stands upon a platform while being filled and is subjected to constant jarring. The barrels are in this way very satisfactorily packed without manual labor; in fact, the very limited number of workmen employed is as noticeable in this department as in other divisions of the works. A staff of 12 men suffices to maintain uninterrupted manufacture day and night, the output being 15 tons of ammonium nitrate each 24 hours.

ELECTRIC POWER.

It is an interesting fact that the great works at Notodden are without chimneys, for no fuel is used. All heat required is furnished by reducing the temperature of the gases issuing from the furnace. The ultimate source of this heat, and of all the heat and power in the works, is the water power of two neighboring waterfalls, Svaelgfos and Lienfos.

The Svaelgfos power house is 3 miles from Notodden. It was constructed in 1906 when the necessary dam was completed to secure a fall of 165 feet. The volume of water is 75 cubic meters (or metric tons) per second. Four flumes cut in the solid rock conduct the water to the station, where there are four sets of turbine generators, each of 10,000 horsepower. The generators, which weigh 105 tons each, are capable of evolving 13,000 horsepower and rank among the largest units in the world. Power is transmitted to Notodden by four separate lines. Each line consists of six proper cables 12 millimeters in diameter. The 3-phase alternating current, of 50 periods, is transmitted with a voltage of 10,000 volts. Additional regulation of distant lakes in the same watershed will soon increase the normal volume of water to 90 cubic meters (tons) per second, and a second power house, with two units, each likewise of 10,000 horsepower, is now under construction.

At Lienfos, about 2 miles from Notodden, a dam with a fall of about 55 feet was completed in 1911. The same volume of water is utilized as at Svaelgfos. The power station is equipped with four units, each of 5,000 horsepower. Immediately before connection with the electric furnaces the currents pass through enormous safety coils. With cables and electrodes operating under a tension of 10,000 volts it is necessary to provide with extraordinary care against accidents. The relations of current and tension and the solution of many technical difficulties at Notodden offer much to the electrician that is novel and instructive. One of the chief problems has been to establish accurate measurements of the amounts of the electric energy consumed under the conditions above outlined.

LOCATION OF THE WORKS.

The Notodden works are admirably situated. The lake is 50 feet above sea level, and a short canal at its lower end, with a series of

locks, permits communication with the town of Skien, an important seaport at the head of one of the deep fiords of southern Norway. Under present conditions vessels of 200 tons burden can ascend to Notodden. It is planned to enlarge the docks so as to allow the passage of seagoing vessels of 2,000 tons. This ability to ship directly to all parts of the world by water, with at most only one transshipment, is an important factor in the future of the Notodden nitrate industry.

SCHÖNHERR PROCESS.

EVOLUTION OF THE METHOD.

Almost contemporaneously with the Norwegian inventors, Dr. Otto Schönherr, of the staff of the famous Badische Anilin- und Soda-fabrik, with the assistance of the electrician Hessberger, perfected an electric furnace for the oxidation of atmospheric nitrogen which, after the most exhaustive trials, now seems destined to win recognition as an even more effective device than that of Birkeland and Eyde. Ample funds had been placed at the service of the "Badische" by the late Heinrich von Brunck, at the beginning of the century, to further the solution of the problem.

Schönherr's fundamental patent (German patent 201279) bears date of June 24, 1905. His furnace is by no means an elaboration or perfection of the essential features of the Norwegian invention. It is, on the contrary, thoroughly independent and unique in its basic principle and in the manner of its employment. At every point there is evidence of the same ingenuity, daring conception, and mastery of detail which characterized the work of his Scandinavian rivals.

In place of the great disk of electric flame he develops a long, slender arc in the axis of a narrow iron tube, through which a current of air is forced.

THE FURNACE.

The type of furnace now in use consists of a somewhat slender vertical column of iron plate 7 meters (23 feet) in height. This is lined with a nonconductor of refractory material. In the center is a core of three concentric tubes of iron. The inner tube, 6 inches or less in diameter, is the reaction chamber; the others form channels for the entrance of the air current, and for its exit after coming in contact with the arc. The arrangement is such that a good share of the heat in the outgoing stream of gas is transferred to the incoming current.

At the lower extremity of the reaction tube is the main electrode, an iron bar, movable in a vertical direction through an opening in one terminal of the electric current. The terminal is of copper and is hollow, permitting the circulation of a supply of cold water, so as to prevent an undue rise of temperature. The adjustable iron electrode projects a little above the surface of the terminal and is raised slightly from time to time as the end is worn away by the arc. The electrodes now in use last about three months, the daily wear amounting to 20 millimeters. A new electrode can be substituted for a worn one in a few minutes. The cost of electrodes amounts to a cent or two per kilowatt year.

The reaction tube of iron serves as the second electrode. It is in direct connection with the inclosing tubes and the other metallic

parts of the furnace and this entire system is grounded so as to remove the element of danger. By means of a lever the space between the main electrode and the lower extremity of the tube can be bridged over by a metallic connection and the arc be formed. The same device permits a relighting in the rare case of the arc being accidentally extinguished.

ADMISSION OF AIR.

A distinctive and novel feature in the furnace is the provision for the admission of air. The air current, forced by a powerful aspirator, enters the lower part of the circular space between the two outer tubes. The larger tube is heated by a current of the gaseous products of the operation passing downward through the channel lying between it and the external walls of the furnace. The upward passageway of the entering current terminates at two-thirds of the height of the reaction tube, and the air, already heated to some extent, descends by the inner circular channel, in immediate contact with the hot walls of the reaction tube, to its lower extremity. Here it enters the chamber, or space, containing the main electrode. The entry is through a number of small openings arranged in several horizontal rows in the sides of this circular chamber. The orifices are tangential to the walls of the chamber. The current of gas then passes through the reaction tube, issues from its upper extremity, and descends in the external circular passageway already mentioned. A water jacket surrounds the upper third of the reaction tube. Small windows, protected by mica, allow a view of the chamber containing the main electrode, and also of the space immediately above the reaction tube.

KINDLING THE ARC.

The kindling of the arc is brought about by pressure on an external lever, which causes a metallic bar to slip into position between the main electrode and the lower end of the reaction tube. As the bar is connected electrically to the latter it acts temporarily as a second electrode and the arc springs into existence. Various other methods have also been used successfully. A moistened shaving of wood introduced into the free space suffices so to increase the conductivity of the air that the discharge can take place. Or a small flame directed into the open space will heat the air sufficiently to raise its conductivity to the point at which an arc can bridge over the space between the electrodes. A block of wood wound with wire has also been employed; and the discharge of a blank pistol cartridge into the chamber will likewise bring about the desired result.

The arc springs into activity in the midst of a rapidly moving current of air. As a result it is swiftly drawn upward, so that it forms a slender column of flame occupying the axis of the reaction tube for its entire length. It is intensely luminous, but burns quietly and noiselessly. The flame does not come in contact with the reaction tube except at its upper extremity. A second electrode can be stationed near the top, in which case it is not necessary that the reaction chamber tube should be of metal. The initial lighting is accomplished by introducing a wire momentarily between the two

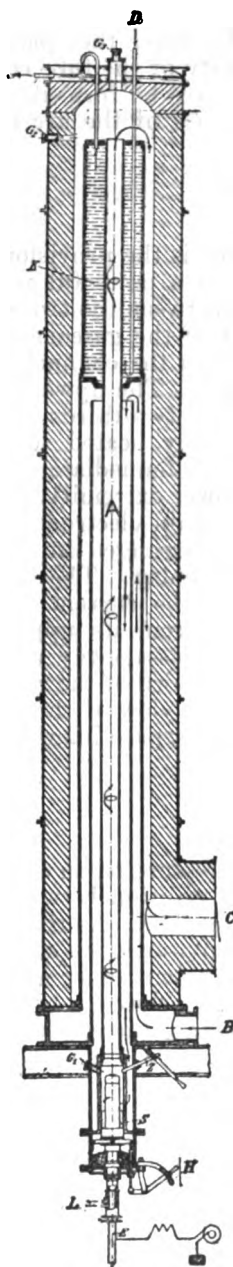


FIG. 2.—Schönherr furnace: A, reaction tube; B, entrance of air current; C, exit of gases; D, circulation of water about the upper portion of the reaction tube; E, electrode; G, windows; H, lever to control admission of air; K, water jacket; L, water circulation to cool electrodes; S, tangential openings for admission of air; Z, lever for kindling the arc.

electrodes. These long constant flames are of the greatest interest to physicists, as hitherto arcs of any considerable length have been of uncertain duration. With a tension of less than 4,000 volts Schönherr has secured columns of flame 26 feet in length; greater lengths can probably be produced. For technical purposes a flame of 23 feet seems to be the most practical.

THE REACTION TUBE.

The movement of the ascending column of air in the reaction tube is a feature of dominating importance. It enters the chamber about the lower electrode under a pressure of 50 to 100 centimeters of water and is raised to a temperature of 500° C. by the heat transmitted by the outgoing current. A higher temperature does not seem safe in an apparatus constructed of wrought iron, and the movement of the current is adjusted so as to prevent overheating. It is, however, the rapidity of movement that controls the length of the flame, and it must not fall below a certain rate. The chief peculiarity of this flame results from the method of its introduction into the electrode chamber, i. e., tangentially through a number of small openings. The total section of these openings is less than that of the circular canal conducting the air, thus insuring a uniform pressure in the numerous minute currents on entering the chamber. As a result a very pronounced vortical motion is imparted to the entire ascending column of air, a motion so strong that there is a material difference in pressure between the axis of the vortex, occupied by the column of flame, and the outer sections of the current. As the air nears the top of the tube, the spiral motion gradually loses its intensity, and the characteristics of a gaseous vortex are less pronounced. Numerous variations in the manner of introducing the air current have been tested. Fairly good results have been secured by admitting it above the main electrode; it has also been admitted directly into the

reaction tube through small orifices or slits of different shapes and positions. The controlling factor is the production of the pronounced vortical motion. A slight deviation from the horizontal location of the openings, as described, seems favorable for this purpose.

The best results have followed a somewhat more complicated system of introducing the air. By forcing hot air into the lower chamber immediately above the electrode, and cold air a little higher up, it is possible to create a vortical column, the center of which is much hotter than the inclosing strata. There are certain evident advantages in this arrangement for producing a maximum effect in the chemical reaction. In a recent patent (German patent 229292) the "Badische" company proposes to impart spiral motion, in opposite directions, to the two columns—the central "core" and the inclosing mantle.

NATURE OF THE REACTION.

The reaction is identical with that obtained in the Birkeland and Eyde furnace. The union of nitrogen and oxygen to form nitric oxide takes place in contact with the electric flame. As the products escape from the zone of great heat into the colder outer portions of the current the temperature falls so rapidly that the reverse reaction (the splitting up of nitric oxide into its constituents) is prevented to a notable degree. This quick cooling, which is all-important in securing a good yield, is further facilitated by inclosing the upper third of the tube with a water jacket. The net result is that the air current issues from the top of the reaction tube, with a temperature of only 1,200° C., and that the amount of nitric oxide present, as a product of the brief contact with the arc, is materially above 2 per cent, reaching even at times, it is claimed, 2.5 per cent. As compared with a Birkeland and Eyde furnace, the Schönherr device, apart from its somewhat higher yield, is characterized by its simplicity of construction and its durability. There are no movable parts, except of necessity the lower electrode, there is no costly electromagnet, and use is made of ordinary iron piping in building a furnace. The degree of safety in operating such a furnace is marked.

THE LONG ARC.

In one respect Schönherr boldly differed from the accepted rules for securing a maximum yield of nitric oxide. Instead of aiming to have a given volume of air remain momentarily in contact with the arc and then come into a zone of colder air or pass over a chilled surface, he forces the entire volume to remain for a measurable length of time within the range of activity of the arc, while passing the entire distance through the long narrow reaction tube. The same end is attained, however, and apparently somewhat more successfully, by imparting the vortical movement to the ascending air column (with its resultant lowering of pressure in the center), by cooling the lower section of the reaction tube with the help of the inflowing current, and by cooling to a still greater degree the upper section of the tube with the aid of water. This means, of course, that temperatures fall very rapidly between the arc and the walls of the tube. It should be mentioned in this connection that Prof. Guye, in his experiments with a Schönherr tube, finds that the immobility of the long arc is not due

to the vortical motion of the air current. The flame is quite as stable when air enters freely at the lower end of the reaction tube. This property he attributes rather to the increased viscosity of air at the high temperature prevailing in the center of the arc. An increase of 500° C. in temperature means a quintupling of the viscosity of nitrogen.

EXPERIMENTAL FACTORY AT FISKAA.

In 1905 the Badische Anilin- und Sodafabrik erected a small experimental factory at Fiskaa, near Christianssand, in southern Norway, where Dr. Schönherr began actual manufacture in the autumn of 1907. Electric power in the form of an alternating current of 25,000 volts was furnished from a small water power at Kringsjaa, 16 miles distant. At the factory it was transformed to a current of 4,200 volts and 105 amperes. The maximum power available was 1,300 kilowatts. This was divided equally among three furnaces, each using about 440 kilowatts, or 590 horsepower. In this factory Dr. Schönherr has studied and perfected all the details of the operation. The nitric oxide produced has been utilized chiefly to manufacture sodium nitrite, of which the "Badische" requires annually large amounts.

COMBINATION OF THE NITROGEN INTERESTS.

After the merits of the Schönherr furnace were fully established, two other powerful German chemical companies, likewise using large quantities of nitrite, united forces with the "Badische" to form a joint organization for the exploitation of the new process. This organization, in turn, combined with the Norwegian company owning the Birkeland and Eyde patents, so as to preclude any competition in the common field. It was decided to pursue uninterruptedly the investigations to determine which type of furnace was better adapted to solve definitely the nitrogen problem, and to lay far-reaching plans for the utilization in the new industry of the hydroelectric resources of Norway. In accordance with this plan steps were promptly taken to secure possession of several available sites. The chief acquisitions are works at Wamma, Tya, Matre, and Rjukan.

LOCATION OF THE CHIEF FACTORIES.

At Wamma, on the lower Glommen River in southeastern Norway, a dam is now in process of construction that will afford 55,000 to 72,000 horsepower, according to the season of the year. At Tya, in western Norway, northeast of Bergen, 81,000 horsepower will be developed, and the works at Matre will, when completed, furnish 83,000 horsepower. Rjukan is in Telemarken, northwest of Notodden. The Rjukan fall is on the upper part of the basin of the River Tinn, which supplies the power at Notodden; it constitutes the chief fall in the descent of the Maana River, through which the waters of Lake Mosvand find an outlet into Lake Tinn. The magnificent works for controlling the water supply, and the great power stations, all planned by Samuel Eyde, are easily the largest in all Europe. When in full operation they will furnish 250,000 horsepower.

Lake Mosvand is a fairly large body of water, its surface exceeding 23 square miles, and is fed by a watershed embracing 662 square

miles. The lake is at an elevation of 3,000 feet. A short distance below its outlet a dam of concrete 594 feet long was constructed. The top of this dam is 7.5 feet broad, and the inclination in front is 1 in 15. By means of the dam the level of the lake is raised over 46 feet. This means a storage reservoir of about 840,000,000 cubic meters (tons) of water, which is nearly equal to the amount retained by the Aswan Dam in the Nile. The minimum flow in the river below is increased from 5 to 47 cubic meters per second. The reservoir cost about \$415,000, which is a fair sample of the cost of extensive plants in Norway. In this instance the increase of the minimum water power from 30,000 horsepower to 250,000 horsepower involved an outlay of slightly less than \$2 per extra horsepower. The outlay per cubic meter of water thus stored up was about 0.054 cent. Many difficulties attended the construction of this dam on account of the climate, the elevation, and the distance from roads.

Five miles below the dam another dam forms the intake for the power station. From this point a tunnel, 289 square feet in section, leads to a reservoir blasted out of the solid rock at the brow of a cliff near the picturesque Rjukan' fall. The tunnel has a length of 2.6 miles, and a descent of 1 in 300. It was constructed by driving adits into the rock at regular intervals and tunneling from them in both directions.

POWER STATION AT VEMORK.

The power station of Vemork lies on a shelf in the face of the cliff 1,000 feet below the terminal reservoir of the tunnel. The water is conducted from the reservoir down the mountain side to the turbines in 10 huge flumes, placed side by side. These flumes are 5 feet in diameter. The upper sections are of riveted steel plate; the lower, where the pressure reaches 30 atmospheres, are made of welded plate 1 inch in thickness. They rest upon foundations built upon the solid granite of the mountain.

The water descends 971 feet to the Vemork turbines. The supervising engineers count upon a total loss of about 62 feet, so that the effective height is 909 feet. Of this loss, 29.5 feet occurs in the tunnel, 19.7 in the flumes, and the remainder in the turbine house. Immediately upon leaving the power station the water enters another tunnel, excavated in the side of the cliff, and is conveyed to a point, 3.1 miles down the valley, where a similar series of flumes, and a duplicate of the upper power house are now under construction. The total fall here is 909 feet, and a deduction corresponding to that given above must be made.

In the Vemork power house are 10 units, each of 14,000 horsepower. Pelton wheels are used in the turbines, on account of the great pressure of the water. They have a maximum capacity of 17,500 horsepower. The double generators installed are furnished by the leading German electrical firm—the Allgemeine Elektrizitäts-Gesellschaft. A three-phase alternating current of 50 periods is transmitted from this power house to the nitrate works through 60 wires, partly of copper but chiefly of aluminum. The working voltage is 10,000.

THE WORKS AT SAAHEIM.

The nitrate works are located at Saaheim, 3 miles lower down the valley, where also the second power house will be built. This valley

presented, at the time of my visit in the autumn of 1911, a scene of remarkable bustle and activity. A few years ago its population was limited to a small number of farmers, gaining with difficulty a scanty living in the deep, narrow valley where for months the sun is not visible. A small hotel was perched on the cliff near the falls for the convenience of tourists. It was reached by a narrow road leading from Lake Tinn along the rushing waters of the Maana.

A railway communicates with the lake, and a town of considerable size has sprung into existence, rendered necessary by the employment of over 2,000 workmen in the preliminary constructions, and by the prospective housing of between 2,000 and 3,000 permanent operatives. Residences of supervising engineers dot the hillside. Hundreds of comfortable workmen's houses are approaching completion. Careful provision is made for drainage, lighting, a hospital, and the other essentials of the municipal life of a town of 12,000 inhabitants.

Interest centers about the factories, where all the water power is to be used, and whence the future population is to draw its support. These cover a large area. The electric furnaces require 86,000 square feet, and an equal space is occupied by the absorption towers. The latter are of practically the same construction as those at Notodden.

FURNACE ROOM.

A quite different view, however, is afforded in the great furnace room. Here are stationed 96 Schönherr furnaces, and 6 of the Birke-land and Eyde type. The former are of 800 and the latter 3,000 kilowatt power. The long rows of Schönherr furnaces present a graceful and imposing appearance. They rest upon massive iron girders that are supported by pillars of brick.

The chamber containing the lower electrode is narrower than the main column and descends between the sustaining girders. Its bottom is about 3 feet above the floor. The long iron bar, serving as an electrode, descends into a pit, about 9 feet deep, in the floor. By means of a cog mechanism the position of the electrode is easily regulated, and it is raised from time to time to keep pace with the gradual corrosion at its end. A screen of wire gauze incloses the electrode and the lower end of the furnace. Alongside stands a low pillar, with the levers for controlling the current, and the customary indicators. Large pipes containing air under pressure pass along the base of a row, with connections to each furnace. The volume of air admitted into a furnace is 11,000 cubic meters hourly. Still larger mains connected also with the base of each furnace conduct the hot gases produced to the cooling apparatus and oxidation chambers. The temperature on leaving the furnace is 850° C. The upper part of each column is of slightly larger diameter than the lower, on account of the space occupied by the water jacket. A platform runs along the top of a furnace row, which has an elevation of about 32 feet above the floor, and allows easy control of the water connections and inspection of the interior of the furnaces through small windows. The mechanical equipment is such that one operative is able to supervise six furnaces.

The switchboard for controlling the current supplied to this extensive installation is of enormous size, probably the largest of its kind in the world. It is worthy of note that thus far the care exer-

cised in utilizing such great volumes of electricity in the nitrate industry has been such that no accidents have occurred.

The arrangements for oxidation, for absorption, for the transformation of nitric acid into nitrate, and for the economical utilization of the waste heat, do not vary materially from those now in use at Notodden.

TRANSPORTATION FACILITIES.

To handle the products of these works it has been necessary to build two railroads—one of 10 miles from Saaheim to Lake Tinn, and one of 19 miles from the lower end of the lake to Notodden. Steamboats and large barges provide transportation on the lake over the stretch of 19 miles between the terminals of the railroads. Freight cars are run directly on the barges. From Notodden to the seaport of Skien, a distance of 37 miles, there is transportation again by water. It is thus possible to ship nitrate from Saaheim to the seaboard without breaking bulk. At an early date it will probably be possible to effect communication at Notodden with seagoing vessels. For the time being, the company plans to establish vast warehouses at Skien. At present the movement of freight is almost entirely in the direction of Saaheim, enormous quantities of machinery, tools, structural iron, and general supplies coming from Christiania. When the works are in full operation the current will be chiefly in the other direction. The raw materials are air, water, and limestone.

PAULING PROCESS.

DEVELOPMENT OF THE METHOD.

The problem has been attacked in a somewhat different manner by Harry and Arthur Pauling. They produce a large sheet of electric flame by the use of divergent electrodes, with the aid of an air blast at the point of divergence. The method has been in successful operation on a manufacturing scale for over two years. The essential features are described in the German patents 193366, 193402, 198241, 202763, 203747, 205464, 213710, and 216070.

In his earliest project, H. Pauling made use of a cone of electric flame. The electrodes were hollow and located in a cylindrical chamber; one was pointed and through it a blast of air entered the chamber. The second electrode, placed opposite, terminated in a large saucer-shaped surface, which was perforated with small openings through which the gases passed out. The arc was lengthened with the aid of an air current, as in the Schönherr method. In a later device he used a fixed bar as one electrode. The other was attached, in the form of a spiral, to the exterior of a rotating cylinder of refractory material. Air was forced into the furnace through a number of small openings in a pipe situated on one side between the electrodes. When in operation the arc constantly changed its position from one end to the other of the fixed electrodes, thus permitting rapid contrasts of temperature in the air current. In 1906 the Paulings patented the process now in use, the rights to which have been acquired by the Salpetersäure-Industrie-Gesellschaft. An experimental plant was erected at Gelsenkirchen. This was succeeded in 1909 by a permanent plant near Innsbruck in the Austrian Tyrol.

THE FURNACE.

In the Pauling furnace curved electrodes are so located that the lower portions are in close proximity, while the upper portions are inclined at an angle of 90° to each other. Narrow "kindling blades" pass through slits in the curves. By means of the handles, connected by isolators, these blades can be adjusted very accurately, so as to present at one point a very short distance for the passage of the electric arc. A pipe immediately below this point serves for the entrance of an air blast. Its nozzle is so constructed that the air current issues in the form of a fan and fills the space between the inclined electrodes.

ELECTRIC ARC.

When an alternating current is passed through the circuit, an arc is formed between the nearest points of the two electrodes, viz, between the extremities of the narrow adjustable blades. Under the pressure of the air blast it is forced upward, fills the space between the electrodes, and projects far above them, attaining ordinarily a total height of 25 to 30 inches. To the eye, there is a continuous flame. Actually, with the rapid alternations of the current, the flame forms, only to vanish almost instantaneously and to reappear as quickly, being rekindled at the lowest point, where the terminals are nearest one another. The action of the sheet of flame is the same as in the other processes already described. The chief merit of the Pauling method lies in the very simple but practical provision for rekindling the arc at each half period of the electric current. The problem involves two leading factors. The distance between the electrodes at their nearest point must be sufficient to allow the easy passage between them of the powerful blast of air, without any material interference in the latter's direction, as influenced by the construction of the nozzle. This distance is ordinarily 40 millimeters (1.5748 inches). Such an interval demands, however, an electric current of exceptionally high tension in order to kindle the arc, especially when the rapid stream of air is passing through it. Once in activity the arc is maintained with the aid of a current of low tension. It is here that the "kindling blades" come into play. They are so narrow that they offer practically no obstruction to the blast of air passing the bulky electrodes. They are adjusted so that their extremities almost touch. (The actual distance is 2 to 3 millimeters.) An electric current of low tension can thus be used to rekindle and maintain the sheet of flame. Once kindled between the points of the blades, it instantaneously fills the fan-shaped space between the main electrodes.

ELECTRODES AND KINDLING BLADES—COOLING PROCESS.

The electrodes are made of cast steel and are kept cool by the circulation of a current of water. They last for about 200 hours. The "kindling blades" are naturally more rapidly corroded, and it is necessary to adjust them at frequent intervals so as to insure the proper distance between their points. They last about 20 hours, but are easily replaced. The easy adjustment of the blades, combined with the permanent location of the electrodes, are all-important features. The resultant flame presents to the eye the appearance of uniform size and intensity.

COOLING PROCESS.

The Pauling system includes another valuable feature in connection with the cooling of the current of air which has passed through the flame. A portion of the current, which after issuing from the furnace has been cooled down to the proper temperature to enter the peroxide chambers, is switched off before reaching the latter and blown into the upper parts of the flame from nozzles placed at its edges. The pressure of this cooling current is less than that under which the main air stream enters between the electrodes. As a result the gases in the upper zones of the flame are rapidly chilled to a much lower temperature, and the secondary current exerts a certain suction, which broadens and heightens the sheet of flame. The gas stream leaving the furnace contains 1.15 to 1.5 per cent of nitric oxide.

OPERATION.

As in the other processes already described, the Pauling electric flame operates inside a furnace of refractory material. It has been found that the best results are secured by employing two arc flames in a single furnace.

The type of furnace now in actual use requires a current of 400 kilowatts for each unit in operation, with an electromotive force of 4,000 volts. A volume of 21,200 cubic feet of air is blown into a furnace in the course of an hour. One operative attends to 6 furnaces, and the factory of the company now includes 24 furnaces. One peculiar feature connected with the transmission of the current to the Pauling furnaces deserves notice. By its aid a number of furnaces can be introduced into a single circuit. As stated above, two arcs are employed in each furnace, and these are fed by a single current. This is rendered possible by connecting the middle pole of such a system (which is carefully insulated against earth connections) with one of the two terminal poles. For this union a conductor of very high resistance is employed. This device allows of the following sequence of changes in the alternation of the current employed. At a given instant the entire voltage is brought to bear at the interval between two electrodes, where the arc has been interrupted. As soon as the arc is reestablished the tension at that point sinks notably. The entire voltage is then directed upon the poles separated by the high resistance. As these, however, are also poles for the companion arc, a tension nearly as high as that available for kindling the first arc is now active in kindling the second arc. In the instant when the latter is formed the circuit is completed through the two electric flames and the voltage is exerted in creating the two sheets of flame.

By an additional device a number of furnaces can be linked in the same circuit. This consists in the use of an ancillary electric current of very high electromotive force but of low power. By an ingenious switching method this secondary current comes into play as high tension is needed for kindling arcs, but is shut off as the main current develops the several sheets of flame. This method overcomes the difficulty arising from the fact that a much higher electromotive force is required for kindling an arc than for its maintenance when

once kindled; in consequence, the energy of the current can be devoted almost exclusively to the maintenance of the flame, the central feature of the manufacturing process.

PRODUCTS OF THE FURNACE.

The gas stream leaves the furnace at a temperature of about 1,000° C. It is cooled, the nitric oxide is transformed into peroxide, and the latter changed into nitric acid, much as described previously in connection with methods now used in Norway. The heat of the furnace gases is utilized in heating the air blast forced into the furnaces, and in evaporating the solutions of nitric acid, of nitrites, or of nitrates obtained as final products. Thus far nitric acid is almost the sole product, as nearness to extensive markets renders it much more profitable than any form of nitrate at current prices.

A system of pipes and towers of earthenware is used for the acid formation and absorption. The strength of the acid issuing from the towers ranges from 35 to 40 per cent. It is concentrated to a 60 per cent acid by the aid of the heat in the furnace gases.

The last traces of oxides in the current of gases issuing from the absorption towers are extracted by forcing the stream through a solution of alkaline hydrates and transforming the oxides into nitrites, as previously described.

The industrial operation yields 60 grams of anhydrous nitric acid, HNO_3 , per kilowatt hour.

The Pauling process combines a much greater variety of clever devices to utilize the electric current than do the rival methods, and yet from a mechanical standpoint it is necessarily simple in constructive features, capable of easy control, and involves only slight expense for wear and tear. The rapidity of cooling the gases issuing from the zone of maximum temperature is distinctly greater than in the other two processes. It may ultimately prove a formidable rival of the Norwegian systems.

FACTORIES IN AUSTRIA AND ITALY.

The exploitation in Austria-Hungary of the numerous patents covering this process issued to the Salpetersäure-Industrie-Gesellschaft is in the hands of the Luftverwertungsgesellschaft of Innsbruck. Their factory at Patsch uses a water power of 15,000 horsepower and contains 24 furnaces, each with two electric flames.

A nitric-acid factory based upon the Pauling system and using 10,000 horsepower is now in active operation at Legnano, near Milan. Electric energy at this place is supplied at the rate of 25 lire (\$4.82) per kilowatt year, for use especially during the night.

WORKS AT LA ROCHE-DE-RAME.

Another factory has been equipped under the Pauling patents by a French company, Le Nitrogène, at La Roche-de-Rame, near Briançon, in the Department of the Hautes-Alpes. It uses 25,000 horsepower and began manufacture in 1911. According to the contract for construction, the electric furnaces cost less than \$24 for each kilowatt. In the details advantage has been taken of the experience gained in the pioneer establishment at Patsch.

In this factory there are 18 furnaces, arranged in 6 groups of 3 each in a room 50 by 150 feet. Each furnace is of rectangular shape, 3.3 by 4 feet and 10 feet in height. A current of 12,000 volts, with 50 periods, is employed. Each furnace consumes 600 kilowatts. It is planned, however, to raise the consumption of electric power to 1,000 kilowatts in order to insure greater regularity and higher efficiency. The temperature of the external walls of the furnaces does not mount very high, as the result of effective cooling through the entering air current. This air current is forced in by a compressor of 250 horsepower, and is heated in advance by passing through a regenerative system—analogueous to that employed in the Schönherr process—which is likewise traversed by the outgoing current, which possesses a temperature of 1,000° C. on leaving the furnace.

This latter current loses much of its remaining heat by passing through a cooling tower 17 feet in diameter and 39 feet in height, filled with bricks. There are two of these towers. When one becomes sufficiently hot the current of gas is diverted to the other and it is cooled by a strong draft of fresh air. A chimney 85 feet high serves to create the draft. As compared with the Norwegian plants there is evidently a failure to utilize to the utmost the waste heat from the electric arc.

Between the cooling tower and the oxidation chamber there is an additional cooler of aluminum, which finally reduces the temperature to the proper degree. On leaving this cooler a ventilator of 15 horsepower forces the current into the oxidation chamber. This is a tower of reinforced beton 33 feet in diameter and 75 feet high. The walls are 4 inches thick and are lined with acid-resisting brick.

ABSORPTION TOWERS.

A series of five absorption towers are next traversed by the current. Each tower contains 250 tons of fragments of acid-resisting brick. A current of water is forced to pass successively from the final tower of the series to the first tower. The dilute acid secured from the five towers shows a constantly increasing strength—from 10° Baumé to 15°, to 20°, and finally to 30°. The last-mentioned strength corresponds to 40 per cent of HNO_3 .

CONCENTRATED ACID.

A higher concentration is secured by conducting the 40 per cent acid into porcelain vessels, which are placed in a main traversed by a part of the hot gases issuing from the furnaces. This current carries along not only the water which is evaporated but also a small amount of acid. The acid vapors are condensed by directing the current through coils of earthenware pipe. The dilute acid thus formed is added to the stream passing through the absorption towers, while the gas current on leaving the condenser enters the oxidation chambers. By this method a 50 per cent acid is easily obtained. It is possible to secure a 60 per cent acid by forcing the concentration, but as a rule 50 per cent acid is manufactured. The 60 per cent acid is transformed in these works into a 98 per cent nitric acid by adding double its weight of 92 per cent sulphuric

acid and distilling. The product thus secured contains only 0.06 per cent of nitrous vapors. A tower filled with fragments of lava and heated externally is used in this operation. The mixture of the two acids is driven into the tower in the form of spray. Nitric acid in the form of vapor escapes from the top of the tower and is condensed. At the base of the tower 80 per cent sulphuric acid flows out. It is concentrated by evaporation and used repeatedly.

In these works, and also in the works in Tyrol, H. Pauling's electrolytic method for concentrating nitric acid (German patent 180052) has been employed. This method is an ingenious one and comparatively simple. It may be destined to play a rôle of considerable importance in the production of 98 per cent acid from the dilute nitric acid obtained by the oxidation of atmospheric nitrogen. At present the cost of the electric energy consumed appears to be too high to warrant the use of the process on a commercial scale. The operation is so conducted that the oxides of nitrogen formed on the cathode during the electrolysis of nitric acid are conducted directly into the portion of the acid surrounding the anode. Here they are oxidized to nitric acid by the nascent oxygen liberated on the anode. Eventually the acid at this point attains the maximum concentration.

The gases leaving the final absorption tower at La Roche-de-Rame are conducted through sand filters to insure the condensation of traces of acid. They then pass through a series of towers charged with sodium-carbonate solution. A 20 per cent sodium-nitrite solution is thus obtained. It is evaporated with the aid of the heat given off by the furnace gases. The crystals thus secured contain 95 per cent nitrite and 3 per cent nitrate.

The process yields 60 grams of HNO_3 per kilowatt hour.

ORGANIZATION OF THE AIR-NITRATE INDUSTRY.

FRANCO-NORWEGIAN COMPANY.

The three principal processes described are the only ones thus far (January, 1912) in successful operation on a commercial scale. Before considering a group of other processes, still in the experimental and tentative stage, the economic results of these three may be briefly reviewed; and the financial outlook of the new industry noted.

The promising results of the preliminary experiments of Birke-land and Eyde led to the formation in 1903 of a Norwegian company, the Aktiebolaget det Norske Kvaestof Compagni, with a capital of 500,000 crowns (\$134,000). This corporation constructed the first small factory at Notodden. In 1905 Swedish, and especially French, capital became interested in the undertaking. The earlier organization was merged into a new company with a capital of 7,000,000 crowns (\$1,876,000), entitled the "Norske Hydroelektrisk Kvaestof Aktiebolaget" (Norwegian Hydroelectric Nitrogen Co.). The Notodden establishment was enlarged to twenty times its former capacity and valuable water-power sites in various parts of Norway were acquired.

THE GERMAN COMPANIES.

During this period the Badische Anilin- und Sodafabrik had pushed forward its tests with the Schönherr furnace in its experi-

mental plant at Christiansand. The value of the new process became evident. Two other powerful German chemical companies, the *Farbenfabriken, vormals Friedr. Baeyer & Co.*, of Elberfeld, and the *Aktien-Gesellschaft für Anilinfabrikation*, of Berlin, joined forces with the "Badische" to develop the Schönherr process. It is probable that all three were actuated by the desire to secure primarily a cheap source of sodium nitrite, which they consume in large quantities, for the production of azo colors. In fact, the small works at Christiansand have produced thus far little but nitrite.

COMBINATION OF INTERESTS.

Under the circumstances, those in control of both processes decided that the best policy was to combine their interests and work in unison. Accordingly, in 1907, they created two new companies. The *Norsk Kraftaktieselskab* (Norwegian Power Co.) has a capital of 16,000,000 crowns (\$4,288,000), and aims to acquire and regulate available water powers in the Kingdom. The *Aktieselskabet de Norske Saltpeterwerker* (Norwegian Nitrate Works Co.) has a capital of 18,000,000 crowns (\$4,824,000) and confines its activity to the manufacture of nitrates and allied products. This creation of two distinct companies, one occupied with the development of power, the other with its utilization, is in imitation of the procedure of the capitalists who established electrochemical industries in Switzerland.

The Franco-Norwegian company and the German group each subscribed to one-half of the shares in the two new companies. The former retained its factory at Notodden and continued its operation. The latter did the same with its small plant at Christiansand.

All the energies of the newly founded companies were directed at once to the erection of the power works at Rjukan, and to the erection at Saaheim of the vast nitrate works that are to begin operation in 1912. In the meantime every possible effort was made to determine which type of furnace was capable of yielding the most satisfactory commercial results. At the outset there were indications that the Schönherr furnace, apart from greater simplicity of construction and consequent cheapness of installation, was able to yield slightly more nitric acid per unit of electrical power consumed than could be secured from its rival. Engineers at both Notodden and Saaheim assured me that there was but little difference in the output, and that a year or two more of active testing would be necessary before a decision could be reached. Yet there is much to indicate that the Schönherr is gaining in favor.

FINANCES OF THE FRANCO-NORWEGIAN CO.

The confidence of capitalists in the future of the industry seems to be firm, and the Franco-Norwegian company has had no particular difficulty in securing funds in the Paris market. Its capital in January, 1912, reached a total of 29,639,660 crowns (\$7,943,430). At the annual meeting in May, 1911, dividends were declared of 5 per cent on ordinary stock and of 8 per cent on the preferred stock. There seems to be, however, a certain speculation in the stock. Shares of 250 francs (\$48.25) issued early in 1910 at Paris were quoted for awhile at 380 francs (\$73.34); in January, 1911, they sank as low as 293 francs (\$56.55).

At a meeting of the company held at the close of November, 1911, it was decided to increase the capital stock by 13,000,000 to a total of 42,693,660 crowns (\$11,441,900). Simultaneously, a 5 per cent bond issue of 25,000,000 crowns (\$6,700,000) was taken up by prominent Paris banks—the Société Générale, the Banque de Paris et des Pays-Bas, and the Crédit Lyonnais. At the same time the German group disposed of its interests in the two companies to the original Franco-Norwegian company, so that the latter now controls the Norwegian nitrate industry. Under the new arrangement the German group holds a large block of the stock of the Franco-Norwegian Co. and is represented in the board of directors, but is no longer on terms of financial equality, and the "Badische" has diminished very largely its share in the enterprise.

Much more capital will be needed before all of the water power now under the control of the company can be regulated and used in the production of nitrates. At the lowest estimate \$50,000,000 will be required.

COST OF FURNACE PRODUCTS.

Closely connected with the projects for expansion in Norway and the extension of the industry to other lands is the whole question of the actual cost of the products of the electric furnaces. As the dominating factor is the cost of electric energy used, calculations have been based chiefly on the ratio between the consumption of electric power and the production of nitric acid. The former is measured in kilowatt hours, the latter in grams of pure acid, HNO_3 . The degree of concentration of nitric oxide in the gases issuing from the furnaces is also of importance, as affecting the yield in the absorption towers, and the percentage of nitric oxide actually secured in the form of acid or salt. This concentration is expressed by the average percentage of NO in the gas current.

The most reliable data on the present normal output of the best types of the three furnace systems give the following figures:

Furnace.	Grams of nitric acid, HNO_3 , per kilowatt hour.	Concentration, percentage of NO.
Birkeland and Eyde.....	70	2.0
Schönherr.....	75	2.5
Pauling.....	60	1.5

In 1907, when the market price of the product was 4 cents per kilo (2.2 pounds), Birkeland and Eyde stated that the cost of manufacturing calcium nitrate was 2 cents per kilo. The current rates at Hamburg for Chile saltpeter were then very high, the cost of 1 kilo of nitrogen in that form being about 33 cents. The cost of producing 1 kilo in the form of Norway saltpeter being only 14 cents, there was evidently a large margin of profit. With the cost of nitrogen in Chile saltpeter as low as 25 cents during 1911, the profit was still considerable.

PRICES AND PRODUCTION.

For many years the price of Norway saltpeter must be controlled by that of Chile saltpeter, at least as long as the manufacture is dependent on extremely cheap water power. There will, therefore, be no material cheapening of the price for the benefit of agriculture under the present conditions. In fact, all the water power of Europe would not suffice to produce one-half of the nitrate now required in the world's markets.

With the present output the manufacture is limited to such regions as Norway, where power on a large scale can be secured for \$3 per horsepower year. Prof. Flusin, of Grenoble, calculated that with the rates for water power now prevailing in France 1 kilo of combined nitrogen would cost 34 to 49 cents.

The actual production of nitrate in Norway shows the rapid growth of the new industry. In 1905 the export of calcium nitrate was 115 tons; in 1907, 1,344 tons; in 1910, 13,531 tons. The export of sodium nitrite rose from 900 tons in 1908 to 3,200 tons in 1910. In the latter year 1,074 tons of sodium nitrate were exported. It is estimated that about 2,000 tons of calcium nitrate are used annually as fertilizer in Norway. Including a certain amount of nitric acid for local consumption, the total production for 1910 was equivalent to about 22,000 tons of calcium nitrate.

Of the exports of calcium nitrate in 1910 the bulk went to three countries, viz, Great Britain, 5,100 tons; Germany, 4,791 tons; Netherlands, 1,687 tons; other countries, 1,953 tons. Nearly the entire export of sodium nitrite went to Germany. When the water power at Saaheim is completely utilized for the production of nitrate, the total Norwegian output will reach about 160,000 tons. This is equivalent in nitrogen to 5.7 per cent of the world's production of Chile saltpeter in 1910. As has been stated, the manufacture at Notodden is now concentrated very largely on the production of ammonium nitrate. This is much more profitable than using the nitric acid in the production of calcium nitrate.

PROMOTION OF PAULING PATENTS.

As yet the Pauling process has not assumed any great prominence commercially. Financially there has been some unpleasantness in the exploitation of the invention. Under the auspices of the Salpetersäure-Industrie-Gesellschaft, Gelsenkirchen, whose head office is at Cologne, a company was organized at Wiesbaden in 1907 to develop the patents. This company, the Aktien-Gesellschaft für Luftstickstoffverwertung, has been unfortunate in its financial management, and three times since its formation it has been necessary to undergo a more or less extensive reorganization. The factory at Patsch cost much more than was expected. At the close of 1908 a deficit of 83,000 marks (\$20,000) was announced. In 1909 the capital was raised to 2,100,000 marks (\$500,000). In 1910 there was a further addition of 800,000 marks (\$190,000), furnished by French banks, who now control the general management. Hungarian interests are also strongly represented in the company, which now bears the name of Internationale Stickstoff Aktien-Gesellschaft.

The factory at Patsch, near Innsbruck, is managed by the Luftverwertungsgesellschaft G. m. b. H., of Innsbruck, a branch of the

Wiesbaden company. It uses 15,000 horsepower. The Società Elektrochimica Dottore Rossi, at Legnano, near Milan, is manufacturing under the Pauling patents and uses 10,000 horsepower, at a cost of \$4.80 per kilowatt year. The French company, Le Nitrogène, began operating under these patents in 1911 and employs 25,000 horsepower at La Roche-de-Rame, near Briançon, where the power costs 0.05 cent per kilowatt hour.

In all of these works nitric acid is the chief product, a small amount of nitrite being manufactured in order to avoid loss of combined nitrogen from unabsorbed peroxide. They are all situated in close proximity to industrial regions, where large amounts of the acid are consumed, so that the item of cost of transportation is unimportant.

It is obvious that combined nitrogen in the form of nitric acid is the cheapest product obtained by the direct union of the gases present in the air, as it is the primary material for the preparation of the other nitrates. Ordinarily, in chemical industry, the nitrogen present in nitric acid is much more costly than that in nitrates, as its value includes the cost according to current rates for Chile saltpeter, plus the cost of the sulphuric acid required to liberate nitric acid, and the expense of manufacture. For these reasons it seems possible that the Pauling process can be used successfully to a certain degree in central Europe, despite the much greater cost of water power, and also despite a lower yield of nitric acid per unit of electric energy than is secured by the other two industrial methods. That the process is proving a commercial success would seem to be proved by the establishment of the large new plant in France. It is easy to see how the margin of profit must be considerable at these latter works, when the cost of electrical energy to produce 1 kilo of pure nitric acid barely reaches 1 cent. The cost of the water power at La Roche-de-Rame, 37 cents per horsepower year, is less than at any point in Europe, and even less than the estimated cost of the extensive power available in Iceland, viz, 48 cents.

FUTURE OF THE AIR-NITRATE INDUSTRY.

It seems certain that the manufacture of nitric acid and the nitrates from the atmosphere is established upon a firm basis and destined to expand steadily within the limitations fixed by the two main controlling factors: First, the cost of the available electrical energy, and second, the market rate, for the time being and certainly for a fair share of the present century, of Chile saltpeter. These may be considered somewhat in detail.

COST OF ELECTRICITY FROM WATER POWER.

There is great diversity in the cost of water power available for generating electricity. In central Europe, in the Alps, and also in the Pyrenees, there are isolated cases, as noted, where the power is extremely cheap. As a rule, with the extension of the use of electricity for illumination, for motive power, in chemical industries and metallurgy, the value of water privileges mounts steadily, and must eventually be measured by the standards fixed for the cost of electricity as produced by steam or gas engines. In certain countries isolated to some extent from the great industrial movement of the age, such

water rights can be secured at present at exceedingly low rates. This is notably the case in Iceland, where English capital is planning to utilize vast water powers of fairly constant flow throughout the year, at a cost not to exceed 48 cents per horsepower year. Western Norway is peculiarly favored in a combination of heavy precipitation, a great number of mountain streams, and marked uniformity of flow during the year. These valuable features gradually diminish on advancing eastward across Sweden and Finland. The cheapest source of energy in Norway is at Odda on the west coast, where it costs \$1.96 per horsepower year. The cost advances to \$2.94 at Notodden, and ranges up to \$12 in eastern Norway. In Sweden there are some instances where power is secured at rates from \$6 to \$12. In most cases it costs over \$12. In the United States the range is from \$2.50 at Sault Ste. Marie to \$12-\$20 at Niagara Falls. There are possibilities in Alaska where heavy precipitation is combined with great elevation. There would appear to be great possibilities on the Zambesi, and along the slopes of the mountain regions of equatorial Africa, as well as on the eastern slopes of the Andes. It is the peculiarity of the air-nitrate industry, employing water, air, and limestone almost exclusively as raw materials, that it can be located in the most inhospitable regions, provided that ample water is available and that transportation to the seaboard is not costly.

COST OF ELECTRICITY DERIVED FROM COAL.

The engineers in charge of the Notodden and Saaheim works informed me that they confidently expected a gradual increase in the efficiency of the furnaces. With some increase it may be possible at an early date to use coal as a source of energy for the production of nitric acid at least, and possibly for nitrates. By using blast-furnace gas of about 900 calories in the largest type of gas engine it is possible to generate electricity cheaper than by any other means than water power. The kilowatt hour costs in this case 0.357 cent, or \$23 per horsepower year. In the large power house at Louisenthal there are three steam turbines, each of 3,000 kilowatts. The cost there is 0.714 cent per kilowatt hour, or \$46 per horsepower year. Were it possible to locate this power house at a coal mine, so as to avoid transportation expenses, the cost would be brought down to 0.476 cent, or \$30.70 per horsepower year. Ordinary steam engines are able to generate electricity under favorable conditions at \$61 per horsepower year. It must not be forgotten that with each year there are improvements in the transformation of heat into electrical energy. In the Berlin Electrical Works, four years ago, it was possible to secure 111 kilowatt hours from 1,000 calories. In 1911 the yield was 128 kilowatt hours. While such progress is being made with the use of steam as a source of power, it is probable that the highest economy can be attained by the aid of powerful gas engines.

It is hence quite probable that at no distant date the air-nitrate industry may not be exclusively dependent on cheap water power as a source of electrical energy.

INFLUENCE OF CHILE SALTPETER ON PRICES.

According to the data concerning cost of production communicated by the Norwegian manufacturers there is a very wide margin at present between the actual cost of nitrogen in the form of Norway

saltpeter and the current commercial cost of nitrogen in the form of Chile saltpeter. The natural result will be to multiply factories for producing synthetic nitric acid, utilizing more and more expensive sources of electrical energy, until the cost limit is reached at which the products can be profitably marketed.

Synthetic saltpeter is handicapped to some extent by dependence upon capital. For every \$100 of capital invested in Chilean nitrate works there is an annual production of 1.7 tons of sodium nitrate. For the same investment in Norway the annual product at present is 0.32 ton of calcium nitrate, equivalent to 0.27 ton of the sodium salt. This means that the synthetic product requires a capital investment 6.3 times as great as that needed in the exploitation of the Chilean deposits. The capital now invested in Chilean works is \$136,000,000. It would require a capital investment of about \$860,000,000 to assure the production of an amount of Norway saltpeter equal to that now consumed by the civilized world, assuming that sufficient cheap water power were available.

If no artificial restrictions are placed upon the output of Chilean saltpeter, a period may eventually be reached when competition will bring about a rapid lowering of the price. The Chilean industry is able to accommodate itself to a certain range of fluctuations, as shown by the average prices per ton of saltpeter in European ports during the past 30 years: 1881-1885, \$53.28; 1886-1890, \$43.05; 1891-1895, \$40.82; 1896-1900, \$35.72; 1901-1905, \$44.58; 1906-1910, \$47.63.

Very sharp competition would lead steadily to a closing of the less profitable nitrate works in Chile, on the one hand; on the other hand, establishments producing nitrate with high-priced electricity may find it impossible to struggle against falling rates. The battle will finally be between the cost of electricity in various parts of the world and the cost of fuel, as well as the cost of labor, in Chile. This last factor, the cost of labor, is more elastic than the other two.

There are, however, other determining moments that will effect the problem in varying degrees. The world's demand for combined nitrogen may increase more rapidly than at present, and it may be difficult to meet. The date for the beginning of the exhaustion of the Chilean nitrate fields may arrive more quickly than is now expected.

Synthetic ammonia may assume great industrial importance. The production of ammonia from coal or peat may be developed at a rapid rate, the price of the by-product being exceedingly elastic, and free to a considerable extent from restrictions by ordinary competitive laws.

Atmospheric nitrogen may be secured economically in other forms than ammonia or nitric acid. The manufacture in the form of cyanamide may assume large proportions. The transformation of atmospheric nitrogen into a combined form in connection with certain forms of plant life, as a result of bacterial agency in the soil, may play a large rôle in agriculture and affect the demand for fertilizers.

Finally, the mechanical and chemical methods for converting atmospheric nitrogen into nitric acid and the nitrates may be more highly perfected, so that the normal yield may be notably increased. For the time being this field of invention is attracting the chief attention of European chemists and engineers, and their work may be briefly reviewed.

PROSPECTIVE IMPROVEMENTS IN MANUFACTURE.

Improvements in the manufacture of nitric acid and nitrates from atmospheric nitrogen necessarily fall under two heads: The methods of bringing about the union of nitrogen and oxygen, and the methods of transforming the resultant nitric oxide into commercial products. An enormous amount of experimental work has been and is being done to secure greater economy in the process of oxidation, and the various attempts in this direction may advantageously be first considered.

The great importance of the work attempted in this field is easily appreciated in view of the exceedingly small fraction of the total amount of electrical energy actually consumed in an electric furnace, which is devoted to bringing about the union of the two gases. I was informed by the engineers in charge of the Norwegian factories that only 3 per cent of the heat evolved by the electric current passing through a furnace is exerted in effecting the chemical combination. Of the other 97 per cent, in the case of the Schönherr furnace, 40 per cent is absorbed by the water employed to cool the upper part of the reaction tube, 17 per cent is lost by radiation, 30 per cent is recovered in the boilers traversed by the gas current, and 10 per cent is surrendered to the cooling tube between the boilers and the oxidation chamber. There is, hence, a total loss of 67 per cent of the heat evolved; 30 per cent is utilized for heating purposes, producing results which under ordinary conditions could be secured much more economically by the use of fuel; and only 3 per cent is actually effective in bringing about the union of nitrogen and oxygen. Evidently there is an enormous field for inventive ability. If 6 per cent of the current could be utilized in effecting chemical combination, it would mean the lessening by one-half of the chief item of expense in the process. Every advance in this direction means the possibility of utilizing more expensive sources of electric power.

In the Pauling factory at Patsch more pains are taken to utilize the heat possessed by the gas current leaving the furnace than is attempted in the Norwegian works. This is probably due to the fact that the electric current used by the latter is so cheap. For the time being, it is apparently deemed more advantageous to aim at securing the highest possible degree of oxidation and of concentration in the outgoing gas current. The problem of a more complete utilization of the heat evolved can await the time of extending the process to other lands.

The whole question of a high yield and of an economical use of the electrical energy employed has been made the subject of most exhaustive theoretical studies during the past decade. A short summary of these theoretical results properly precedes a description of the different mechanical devices for reducing them to practice.

PROGRESS IN THE THEORY OF THE REACTION.

At the close of the last century, as has already been noted, several important conditions for the success of the operation of bringing about the oxidation of the nitrogen in the air had been fairly well formulated. The physical and chemical laws controlling these conditions were definitely established during the following years.

They are based chiefly on the researches of Muthmann and Hofer, of Jellinek, of Nernst, and of Haber in Germany, and of Guye in Switzerland.

NERNST'S TABLE OF EQUILIBRIUM CONSTANTS.

The reaction representing the combination of nitrogen and oxygen to form nitric oxide ($N+O=NO$) belongs to the class of reversible reactions. For every temperature at which union between the atoms of the two elements can take place there is a maximum percentage of nitric oxide possible. As soon as this maximum is reached no further increase is possible. This condition of equilibrium may be regarded as one in which the rapidity of decomposition, or dissociation of the atoms in a molecule, is exactly equal to the rapidity of their combination. This maximum of percentage, or equilibrium constant, increases with the rise of temperature. The rate of its increase becomes also steadily higher with each successive rise of temperature. Nernst has constructed the following table showing the maximum amounts of nitric oxide, by volume, that can be produced by heating air, under normal pressure, to various temperatures:

Percentage of NO.	Degrees centigrade.	Percentage of NO.	Degrees centigrade.	Percentage of NO.	Degrees centigrade.
0.5.....	1,663	4.....	2,847	8.....	3,712
1.....	1,938	5.....	3,074	9.....	3,824
2.....	2,310	6.....	3,290	10.....	4,141
3.....	2,596	7.....	3,507		

The lower figures are based on careful experimental data. The higher figures are calculated by extrapolation; their degree of accuracy lessens as the temperature rises.

According to the above table, if the air is heated to 3,300° C., 6 per cent of its volume will consist of nitric oxide. If the temperature is lowered to 2,600° one-half of the quantity is dissociated and reverts to the elementary form so that the air contains only 3 per cent of oxide. As air contains 21 volumes of oxygen the maximum amount of nitric oxide that could be present, theoretically, would be 42 volumes. At the highest temperatures now industrially available the possible yield, or concentration, of nitric oxide must evidently remain far below the theoretical maximum. At the temperatures maintained in the Norwegian furnaces it can not rise above one-seventh of the theoretical yield.

TIME OF REACTIONS.

Were it possible to secure all of the nitric oxide produced in a current of air raised to a given temperature, the whole problem of the utilization of atmospheric nitrogen would be vastly simplified. It would be confined to perfecting devices for attaining the highest possible temperature. However, the chemist here comes in conflict with another series of physical laws quite as rigid in their operation as those limiting the maximum concentration of nitric oxide in a gaseous mixture. These concern the rapidity of combination and of dissociation of the atoms of the two gases present in nitric oxide.

It is necessary to lower the temperature of the gaseous mixture containing the oxides to at least 600° C. before oxidation to peroxide can even begin. In this fall of temperature the conditions of equilibrium are upset, and the force of dissociation grows at a constantly accelerated ratio.

Jellinek has established experimentally the speed at which combination or decomposition of the oxide takes place at different temperatures; or, in other words, the time required at each temperature to bring about the equilibrium of concentration proper to it. There is here an enormous diversity. It takes 10,000,000 times as long a period to attain equilibrium at $1,900^{\circ}$ as it does at $3,000^{\circ}$ C.

Jellinek's first table shows the time necessary at any temperature to produce in air, under normal pressure, one-half of the amount of nitric oxide capable of existence at that temperature according to Nernst's table of equilibrium constants. It is as follows:

Temperature.	Time.	Temperature.	Time.
727° C.	81 years.	$1,827^{\circ}$ C.	5 seconds.
$1,227^{\circ}$ C.	30 hours.	$2,027^{\circ}$ C.	0.2 second.
$1,427^{\circ}$ C.	1 hour.	$2,227^{\circ}$ C.	0.01 second.
$1,627^{\circ}$ C.	2 minutes.	$2,627^{\circ}$ C.	0.0003 second.

Above $2,300^{\circ}$ the reaction is practically instantaneous. The following series was formulated by Jellinek to show the rapidity with which nitric oxide (pure), under normal pressure, dissociates to the extent of one-half of its volume:

Temperature.	Time.	Temperature.	Time.
627° C.	123 hours.	$1,427^{\circ}$ C.	15 seconds.
827° C.	10 hours.	$1,627^{\circ}$ C.	1 second.
$1,027^{\circ}$ C.	44 minutes.	$1,827^{\circ}$ C.	0.07 second.
$1,227^{\circ}$ C.	3 minutes.	$2,027^{\circ}$ C.	0.006 second.

From the above it is evident that at $1,200^{\circ}$ dissociation becomes so slow that it ceases to be an important factor in the treatment of the products of electric furnaces.

PRACTICAL APPLICATION OF LAWS.

In the practical application of the laws outlined above it is apparently necessary that the operation should be carried on at extremely high temperatures, such as can be produced at present solely by the use of the electric arc. It is further necessary that air exposed to any such temperature must be cooled as rapidly as possible to at least $1,200^{\circ}$ C.

With regard to the first condition, it is to be borne in mind that on the one hand oxidation is effected at very high temperatures with relatively less heat than at lower temperatures, due to the diminished specific heat of the gas present; and, further, that the higher the temperature the more rapid the increase in the equilibrium constant. On the other hand, swift cooling down to $1,200^{\circ}$ becomes increasingly difficult, the higher the temperature of the reaction; and the

proportion of calorific energy lost by radiation grows, likewise, at a rapid rate.

The inventor's aim must be to seek a compromise between these extremes. His ingenuity is taxed to devise methods of cooling the reaction gases so swiftly that a minimum of opportunity is afforded for the dissociation of the nitric acid. The formation of the oxide in maximum quantity when air comes in contact with the electric arc, and the dissociation following upon a lowering of temperature until equilibrium is reestablished, takes place almost instantaneously at temperatures above $3,000^{\circ}$ C. The ability to cool a very hot gas down to $1,200^{\circ}$ so rapidly that only a fraction of the nitric oxide present has time to undergo decomposition is the principal requirement in any process for effecting the oxidation of nitrogen.

In all methods thus far in use it is sought to attain the object by the sudden mixing of the particles of the air emerging from the zone of electric flame with masses of colder air. In the Schönherr furnace the chilling of the upper portion of the reaction tube by the aid of a water jacket insures a relatively cold stratum of air in contact with the walls of the tube. The vortical movement of the ascending column of air facilitates the rapid change of particles of gas from the intensely hot center of the tube to the inclosing envelope of a much lower temperature. As a result the current issuing from the top of the tube has a temperature of only $1,200^{\circ}$ C., and over one-third of the nitric oxide formed in the arc is safely rescued and brought into the so-called state of false equilibrium, i. e., the temperature is lowered to the point at which decomposition ceases.

HABER'S THEORY.

Prof. Haber, of Karlsruhe, in connection with various coworkers (notably Coates and König), has advanced the theory during the past three years that heat is not the only factor in producing union of the two gases, but that there is also a specific electrical action due to formation of gaseous ions in the border of the arc flame, a "quickening" of the molecules of the two gases analogous to the transformation of oxygen into ozone under electrical influence.

The basis for Haber's claim rests in the fact that it is possible, experimentally, to produce much higher percentages of NO with the aid of the so-called "chilled area" than Nernst's law provides for. His experiments have been carried on in quartz tubes, which were completely filled with the electric arc and were cooled externally. The cathode was of iridium and the anode of silver, cooled by the inner circulation of water. The distance between the electrodes was only 0.8 millimeter (0.0315 inch). Air was passed through such a tube under a pressure of 100 millimeters (3.937 inches) of mercury. With a current of 100 volts and 0.165 ampere it was found possible to secure concentrations of 10 per cent of nitric oxide. A gas composed of equal volumes of nitrogen and oxygen yielded a product containing as high as 14.5 per cent of NO. One consisting of 4 parts of oxygen and 1 part nitrogen yielded 12.5 per cent. The temperature here did not exceed that of the fusing point of iridium, $2,300^{\circ}$ C., and yet there was obtained a concentration five times higher than that recognized by Nernst's law.

Prof. Haber is forced to the conclusion that purely as an effect of electric action it is possible to bring about an electrical equilibrium of nitric oxide, nitrogen, and oxygen that is much more elevated than the chemical equilibrium. A wide margin of difference between the two forms of equilibrium can naturally exist only at temperatures at which the rate of dissociation of nitric oxide is relatively slow. Hence, the lower the temperature of the arc the more favorable the conditions for securing electrically higher percentages of NO than can be attained by purely thermal means.

In later experiments (1910) on a somewhat larger scale, using electrodes with tips of zirconium, Prof. Haber found a pressure of 150 millimeters (5.9 inches) to give the best results. A current of 1,400 volts and 0.270 ampere secured also the most favorable results.

The best yield secured by the use of chilled arcs amounted to 57 grams of nitric acid per kilowatt hour, or 500 kilos per kilowatt year, with a concentration of 3.5 per cent of NO. The high concentration is important. Prof. Haber is convinced that still higher yields per kilowatt hour can be obtained. In fact, two of his coworkers, Holwech and König, have recently succeeded in raising the yield to 80 grams of nitric acid per kilowatt hour by altering various conditions in the experiments, and G. W. Morden even reached 90 grams.

A new vista is here revealed for the exercise of technical and constructive ingenuity. Thus far it has not been possible to devise an apparatus for the use of chilled arcs on an industrial scale, so that great amounts of electrical energy can exert their power on vast quantities of air, as in the case in the furnaces previously described. But the fact remains that these apparently abnormal high percentages of NO can be attained at relatively low temperatures. The mechanical solution of the problem may be reached any day.

EXPERIMENTS WITH A SILENT DISCHARGE.

Haber's hypothesis of an electrical reaction finds additional support in the experimental researches of Prof. Warburg, of Berlin. He finds it possible to secure the union of nitrogen and oxygen when air is exposed to the action of silent or invisible electrical discharges. These are produced by the passage of an alternating current of high tension, or a direct current subject to frequent interruptions, between electrodes of large surface separated from one another by a nonconductor. The construction is essentially that of the well-known ozone tubes. These consist of two glass tubes arranged concentrically. The exterior of the outer tube and the interior of the inner tube are covered with tin or other metallic foil. When the metal coatings are used as electrodes a pale violet light is visible in the space between the two tubes. If a current of air is passed rapidly through this annular space it becomes charged with ozone. If the current passes very slowly, the sole reaction seems to be an oxidation of nitrogen. Especial interest attaches to this form of oxidation, as the product is not nitric oxide but nitrogen pentoxide, N_2O_5 . This, the highest form of oxidation of nitrogen, when brought in contact with water unites with it instantly to produce nitric acid:



Thus far the yield by this method of oxidation is exceedingly low, and it has not been possible to make it the basis of an industrial process. There is something very alluring about this reaction. If it is eventually found feasible to utilize it on a technical scale, it would offer notable advantages over the manufacturing methods already introduced, as the gigantic and complicated plants for absorption and condensation, now so indispensable, would be unnecessary.

V. Ehrlich and F. Russ (*Monatshefte für Chemie*, XXXII, 917) obtained experimentally very high yields by using silent discharges in closed vessels. When air was employed there was 4.1 per cent of NO in the final product; when equal parts of oxygen and nitrogen were used 13.2 per cent of NO was obtained in the final product; and when the gas used was composed of 3 parts of oxygen to 1 of nitrogen the result was 18 per cent of nitrogen.

The high yields are attributed to the action of an excess of ozone in forming peroxide, which, as already mentioned, does not revert to nitrogen and oxygen in the presence of free ozone. They find that under similar electrical conditions the rapidity of the formation of NO is practically constant no matter what is the composition of the mixture of the two gases. The rapidity of the formation of ozone increases, however, with the increase of the percentage of oxygen. When all of the ozone formed in a given reaction has been used in oxidizing NO to N_2O_3 , decomposition of the N_2O_3 begins as the result of continued electrical action. This continues until a condition of equilibrium is reached and a constant percentage of NO is attained. This equilibrium is essentially electrical in its nature, as distinguished from the thermal equilibrium of Nernst, and the percentage of NO varies according to the mixture of nitrogen and oxygen employed. In the case of air it lies slightly below 1 per cent. It rises with the increased proportion of oxygen and reaches 6 per cent in a mixture of 3 parts oxygen and 1 part nitrogen. This whole field is fully treated in a recent work by Dr. Hugo Spiel, "Ueber die Bildung von Stickoxyden bei der stillen elektrischen Entladung" (Leipzig, 1911).

THE IMPORTANCE OF PRESSURE.

The experiments reveal the fact that pressure is a factor of importance. By lowering the pressure higher percentages can be secured, a fact observed in 1907 by Briner and Durand. As the temperature rises the air and all other gases expand according to a uniform law. This means that the molecules are separated from one another, i. e., the diminution of the number of molecules in a given volume may be attained by reducing pressure. The electrical conductivity of air is increased by reducing the pressure. It is possible that the power of the current to affect chemical changes is affected in the same way, and that the phenomena of increased yield of NO at high temperatures under normal pressure, and at lower temperatures under reduced pressures, are identical in their nature. In the reaction tube of the Schönherr furnace, as a result of the vortical movement of the ascending air current, there is a lowering of the pressure in the center of the air column, and this condition possibly has a certain bearing on the higher yield of NO in the process.

It should be noted in this connection, however, that Muthmann and Hofer found during their experiments in 1903 that while using the higher temperatures of the electric arc a very marked increase in yield accompanied the use of compressed air. Rossi, likewise, in experiments conducted with air under a pressure of 50 atmospheres, succeeded in changing over one-third of the oxygen present into nitric oxide and securing concentrations of 16 per cent nitric oxide. No attempt has yet been made to work on a commercial scale with air under pressure.

HABER'S EXPERIMENTS WITH COMPRESSED AIR.

The rapid increase in the resistance of air to the passage of the electric arc with increased compression has probably been the chief obstacle in this connection. Prof. Haber, however, in 1910, made a number of tests in a small experimental Schönherr furnace as to the actual yield that can be secured per unit of electrical energy when compressed air is employed. A direct current was used with a strength ranging from 0.55 to 1.50 amperes; the voltage varied between 700 and 2,075, and a pressure of from 2 to 20 atmospheres was employed. When the air current was not heated before entering the furnace, the most favorable yield was 76 grams of nitric acid per kilowatt hour. The concentration was, however, only 0.36 per cent NO under a pressure of 2 atmospheres, and 0.29 per cent NO under a pressure of 10 atmospheres. When the concentration was increased to 0.73 per cent NO, the yield fell to 66 grams. On heating the air currents in advance, as is done ordinarily in the Schönherr furnace, a yield of 83 grams of nitric acid per kilowatt hour, with a concentration of 0.76 per cent NO, under a pressure of 4 atmospheres, was the most favorable result recorded.

No account was taken of the large amount of electrical energy consumed in the resistance coils (60,000 ohms) in employing a direct current for the experiments. In view of the high concentration secured, with equally high yields of acid, under diminished pressure, Prof. Haber is led to the conclusion that an increase of the pressure in the air used to feed a nitrate furnace offers no practical advantage in perfecting the process.

YIELD WITH EQUAL VOLUMES OF NITROGEN AND OXYGEN.

In Haber's earlier experiments another favorable condition is noted—that of using a mixture of oxygen and nitrogen in equal volumes. In the air the ratio is 21 to 78. Nernst's calculations show that at a temperature of 4,300° C. theoretically the following results are obtainable:

Mixture of oxygen and nitrogen.	Equilibrium constant, percentage of NO.	Maximum yield of nitric acid per kilowatt hour.
		Grams.
Air.....	10.50	139
One part nitrogen and two parts oxygen.....	12.45	163
Equal volumes of nitrogen and oxygen.....	13.38	174

McDougal and Howles, in 1900, when using a small experimental plant, nearly doubled the actual yield of NO by changing from air to the mixture of equal volumes, and obtained a concentration of 8.5 per cent NO in the cool gases. The fact of a very pronounced increase in the yield is confirmed by Lepel, by Kowalski and Moscicki (who secured an increase of 50 per cent), by Briner and Durand (37 per cent), by Le Blanc and Muranen (29 per cent), and by Guye (16 to 60 per cent). This feature has not yet been introduced into the current processes, although it would seem to be most promising.

Oxygen is now being produced so cheaply that the increased cost of adding 57 volumes of oxygen to 100 volumes of air would seem to be more than made up by the increased yield and by the advantage of having a higher percentage of NO in the gas current passing through the absorption towers. The residual gas issuing from the towers could be directed again into the furnaces. There would naturally be a certain limitation to the repeated use of the gas, on account of the gradual accumulation of argon, as the nitrogen and oxygen are removed, until the large percentage of this inert gas in the current passing through the furnaces would materially interfere with the yield and render its complete expulsion necessary. Obviously there would be an advantage in carrying on the manufacture of nitrates side by side with that of cyanamide or synthetic ammonia, in both of which oxygen is a cheap by-product.

INTRODUCTION OF OXIDIZERS—CATALYTIC AGENTS.

Various attempts have been made to increase the degrees of oxidation by adding such oxidizers as chlorine, bromine, and even ozone to the air subjected to the temperature of the electric arc. No influence on the reaction has been observed except that in the case of the addition of small amounts of ozone the yield of ozone was distinctly lessened.

Other attempts have aimed at the introduction of catalytic agents, but without result. The presence of steam facilitates many chemical reactions, the effect being essentially catalytic. There appears to be no difference, however, in the yield in an electric furnace in consequence of using moist air. Prof. Guye finds, in fact, a very slight increase in the yield when dry air is employed; enough, in his opinion, to warrant the removal of moisture in an industrial plant.

ATTEMPTS TO PRODUCE RAPID COOLING.

A variety of experiments have aimed at the production of very rapid cooling in the immediate vicinity of the arc. These have formed a basis for technical elaboration in such furnaces as the Schönherr, with its water jacket surrounding the upper portion of the reaction tube. Brode's experiments are a good example of the measurements of the results secured by very sudden chilling of the air current alongside an arc. In such a current, yielding a percentage of 4.7 NO after leaving the apparatus, a small platinum vessel, cooled by a constant circulation of water, was brought close to the arc flame. When placed at a distance of 3 millimeters (0.118 inch) above the electrodes the concentration rose to 6 per cent. At 1.5 millimeters (0.059 inch) distance, the concentration rose to 6.9 per

cent. By introducing a chilled quartz tube between platinum electrodes the concentration was raised from 5.5 to 8.1 per cent NO.

In another class of experiments the walls of the tube in which the reaction takes place were chilled externally to very low temperatures. Briner and Durand, in their researches under the direction of Prof. Guye, have secured concentrations of 12 to 15 per cent NO when the apparatus employed was surrounded by a mixture of ether and solid carbon dioxide, and the temperature maintained at -78° C. By immersion of the reaction tube in liquid air at a temperature of -192° C. the entire quantity of oxygen present in the air current was transformed into nitrogen peroxide. There is a question here whether any high concentration of NO was secured. More probably it was changed into peroxide as fast as formed, and the latter was congealed to the solid form and thus constantly removed from the air current. In a short time, under these conditions, all of the oxygen present in air would have entered into combination with nitrogen. In this field, also, there is a prospect of eventually finding a basis for notably increasing the yield of nitric oxide in the oxidation of atmospheric nitrogen.

CHARACTER OF ELECTRIC CURRENT.

The character of the electric current employed has been the subject of a number of investigations, including those based upon the nature and form of the arc flame, and especially the use of chilled arcs, as already noted. The earlier experiments of McDougal and Howes and those of Brode all tended to show that a lowering of the number of amperes and a diminution of the load accompanied, within certain limits, an increase in the final yield of nitric acid. These conditions favored the formation of long slender arcs, and consequently more rapid alterations of temperature. Von Kowalski and Moscicki, in Freiberg, have shown the experimental advantages of currents of exceptionally high frequency combined with low amperage as a basis for the employment of a multitude of relatively small arcs.

The stability of the arc is an important factor and is increased by the use of the alternating current, which maintains a high temperature at both electrodes; stability is also increased by using a high frequency. In general, all that tends to facilitate ionization in the space between the electrodes increases the stability of the arc. A reserve tension in the current is likewise of importance in this connection.

NEW METHODS OF EFFECTING OXIDATION.

The various methods for perfecting the oxidation of atmospheric nitrogen attempt to utilize in differing degrees the methods that have been outlined. These devices will be considered briefly.

THE VON KOWALSKI AND MOSCICKI PATENTS.

In 1903 Von Kowalski and Moscicki patented a method (German patent 174564) in which the principle of high frequency was the most pronounced feature. A current of 50,000 volts and 0.05 ampere was employed, with a frequency of 6,000 to 10,000 periods

per second. Energy was developed in the form of numerous slender arcs 24 centimeters (9.45 inches) long. Much ingenuity was exhibited in so arranging them as to assure continuous flames. The furnace contained six parallel arcs. The *Initiativkomité für die Herstellung von stickstoffhaltigen Produkten* was formed in Fribourg, Switzerland, and constructed a small plant with 33 horsepower. The furnace was easily managed, but the yield when air was employed did not exceed 43.5 grams of nitric acid per kilowatt hour. With mixtures of air and oxygen it rose to 55 grams. This was regarded as insufficient, and difficulty was also experienced in finding satisfactory condensers to meet the needs of an industrial process. The attempt to establish a technical plant was given up for the time being. Experiments were, however, continued at Freiberg, and patents for improved methods were issued to Moscicki. These are so promising that they have been taken up by the *Aluminum Industrie Aktien-Gesellschaft* of Neuhausen. It is said that an industrial plant on a small scale is to be started in the French Pyrenees.

In one patent (Swiss patent 33694) Moscicki locates a wide fish-tail gas flame between the terminals of the electrodes. This is intended to aid in overcoming the resistance of the air at the moment of formation of each arc, when an alternating current is used, and so avoid the necessity of very high tension for an instant. In other patents (German patents 209959 and 236882) he brings into play an ingenious modification of the use of the magnetic field that forms the central feature of the Birkeland and Eyde method. An arc is produced between two concentric, tubular electrodes of copper located between the poles of an electromagnet. Under the influence of the latter the arc rotates swiftly and presents to the eye the appearance of a luminous cone. Air is forced through this conical disk at a suitable speed. A furnace of this type gave a yield of 60 grams of nitric acid per kilowatt hour, or 525 kilos per kilowatt year, which is as high as that secured in a Pauling furnace. In such a furnace a conical form of the rotating flame is secured by blowing in a current of indifferent gas, steam, or air that has passed through the furnace. This enters through the tubular electrode.

In another modification Moscicki does not obtain any higher yield of acid per unit of electric force, but the concentration of NO is materially elevated. One electrode consists of a flat, hollow disk of metal, perforated with numerous holes and chilled by the circulation of water. The conical sheet of flame rotates immediately over the electrode. The air current passing through the flame comes suddenly in contact with this cooling surface, and the temperature sinks swiftly to about 700° C. as it passes through the orifices. The results of the trial of Moscicki's furnace on a large scale will be watched with interest. Several details recall features in the earlier Pauling patents.

THE GUYE FURNACES.

In connection with his brother, Charles P. Guye, and A. A. Naville, Prof. Ph. A. Guye, of Geneva, has done much to advance the general fund of knowledge regarding the oxidation of atmospheric nitrogen, and their studies have found practical expression in several patented devices. Their original furnace, dating back to 1895 (German patent 88320), made use of a current of sparks. Later the arc was employed.

In these early and crude types, which enabled the inventors to formulate much of importance for the development of the process in general, yields were often obtained ranging from 55 to 68 grams of nitric acid per kilowatt hour. These pioneer forms were more complicated than their successors; a single furnace contained 50 to 130 individual arcs.

CHARACTERISTICS OF THE PRESENT FURNACE.

In 1901 Prof. Guye adopted a simpler type, which has gradually been perfected during the succeeding years. His present furnace combines certain features encountered in the devices of both Pauling and Schönherr. The V-shaped electrodes of the former are employed, but instead of a sheet of flame a series of slender arcs are produced, resembling those of Schönherr. Five sets of electrodes are located in a furnace and form a single series or circuit. The electrodes are of metal and are cooled by an interior circulation of water. Immediately above each pair of electrodes there is hung a long, narrow tube or chimney. These chimneys open into a chamber from which a main leads to the absorption system.

In the upper part of each chimney there is suspended a hollow metallic cylinder with inner circulation of water to cool the outgoing air current. Air under pressure enters through the openings in the upper part of the furnace wall inclosing the arcs and their chimneys and descends to the lower openings of the latter. When the electric current passes through such a series of electrodes an arc is formed between the nearest points of each pair. Under the influence of the rapid air current each arc is forced upward and reaches far into the chimney above it.

In appearance it resembles a long drawn-out inverted V resting upon the extreme points of the divergent electrodes. The air ascending the chimney comes for an instant in contact with the arc, oxidation takes place, and there is provision for a rapid fall in temperature, partly through the cooler immediately above the point of the arc and partly through the walls of the chimney, which are chilled by the incoming current of air. As with the Schönherr method, long slender arcs are employed. The difference lies in the substitution of several shorter arcs for one very long continuous arc. In a Guye furnace of five arcs, each a little over a meter (3.28 feet) in length, using 50 kilowatts under a pressure of 5,000 volts, there is a total arc length of about 6 meters (19.685 feet). This compares favorably with the single arc of 5 meters formed in the Schönherr furnace using 440 kilowatts at 4,200 volts.

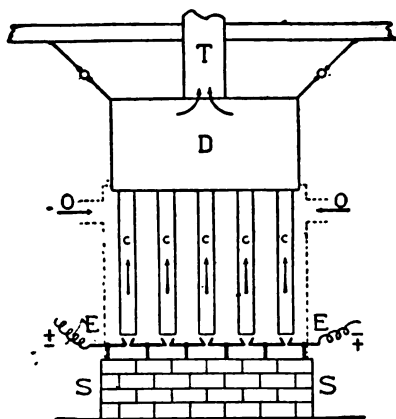


FIG. 3.—Guye furnace, present type: C, tubes, or chimneys, over arcs; E, connections with the electric current; D, chamber for gathering gas currents; T, outlet for gas currents; O, entrance for air, in furnace walls; S, foundation.

The arrangement in tandem of several small arcs replacing a single large arc of the same tension assures a high degree of stability. Each arc serves automatically as a regulator for its neighbors. The total length of the arc is much greater than has been obtained for an equal amount of electric energy in any of the devices hitherto tried. The inventor regards this arrangement as offering proportionally a much greater cooling surface in the immediate vicinity of the flame than is afforded by any furnace working with a single arc, and excellent opportunities are provided for regenerating the heat given off by the arcs. In general the construction is such that the operation is under very easy control, and there is great elasticity in the adaptation of details to varying electrical conditions. For several years tests were made with small furnaces ranging in power from 1 to 4 kilowatts. The yield in these small furnaces rose gradually from 41 to 44.5 grams of nitric acid per kilowatt hour. In 1907 a furnace of 50 kilowatts was set up in Geneva and operated for six months; the yield was 64 grams per kilowatt hour. In 1909 a Genevan company, La Société le Nitrogène, built furnaces of 200 and 400 kilowatts and operated them with the electric current of the Geneva power houses during the night and at such times as there was a surplus of power available. Still higher yields were secured and furnaces of 500 kilowatts were built. The length of the prolonged arc has increased with the use of furnaces of greater power. In the 50-kilowatt furnace a length of 4 meters (13.123 feet) was attained; in the 200-kilowatt furnace a length of 12 meters (39.37 feet); and in the furnace of 500 kilowatts a length of 20 meters (65.61 feet). The process is now in the hands of La Société Electrometallurgique Français for installation on an industrial scale, and a plant is to be erected in the Pyrenees.

A striking feature of the Guye furnace is its simplicity. The smaller types are kept in operation day and night for months without interruption, and require no more supervision than a system of arc lights, and no repairs. Prof. Guye is quite confident of arriving ultimately at a yield of over 85 grams of nitric acid per kilowatt hour, or a ton of acid per kilowatt year. In two French patents (385569 and 385605) his improved methods for transforming NO_2 into HNO_3 are described. They are now in practical operation in connection with his furnaces. The essential feature consists in the compression of the gas current containing NO_2 under a pressure of 5 atmospheres before its entrance into the absorption towers. The result is a more complete absorption, and the production of nitric acid of 95 per cent.

In making modifications in the character of the electric flames produced in a magnetic field for oxidation purposes (German patent 210821), Prof. Guye and his associates found that a duplex motion is imparted to arcs generated by an alternating current in a rotating magnetic field, developed by a second alternating current of a lower number of periods. Such arcs are particularly well adapted for use in oxidizing nitrogen, as well as for other chemical reactions of a similar nature.

PROCESSES DEPENDING ON ELECTROMAGNETIC FIELD.

THORSEN AND THARALDSEN METHOD.

The method patented by Thorsen and Tharaldsen in 1906 resembles that of Birkeland and Eyde in certain respects, and recalls also the last-mentioned feature of the Guye patents. Use is made of a rotat-

ing magnetic field, but there is no attempt to produce a single large disk. In its place are a number of small arcs, which are constantly exposed until the point of rupture is reached. The general effect is much the same as in the Bradley and Lovejoy furnace, and the device is similarly complicated by the introduction of a rotary construction.

PROPOSED MODIFICATION OF BIRKELAND FURNACE.

Prof. C. Birkeland in a late patent (German patent 214445) proposes a radical modification of his furnace. The disk principle is to be abandoned, and recourse had to the long arcs and also to the rotating principle which forms the essential feature of several rival systems. He now advocates a long, cylindrical furnace of iron lined with refractory material. Externally it is enveloped with an induction coil. This is traversed by direct or alternating currents and creates a magnetic field within the furnace. Electrodes enter at opposite extremities of the cylinder, and their axis coincides with that of the magnetic field. The air current enters through orifices around one electrode, and issues through openings about its companion. The arc is kindled by bringing the electrodes near to each other for an instant; they are then withdrawn to the normal distance. As a result of the powerful air current and of the magnetic action, a long spiral flame, rotating in the most rapid manner, is called into action. This device affords an excellent opportunity for the air to come into close contact with the flame, but it seems doubtful whether requisite provision has been made to insure sufficiently rapid cooling of the reaction products. No attempt has thus far been made to apply the construction on a technical scale.

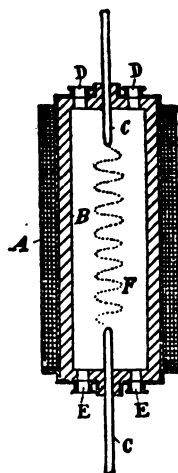


FIG. 4.—Birkeland furnace, new type: A, induction coil; B, cylindrical furnace of iron, lined with fire brick; C, electrodes; D, entrance of air; E, exit of air; F, rotating spiral arc.

ALBIHN FURNACE.

H. Albihn, a Swedish chemist, has devised a furnace (German patent 228755) that is almost the antithesis of the new Birkeland type. The induction coil is located in the central chamber, forming an axis of the furnace. Electrodes are arranged in the form of rings or other designs about this axis. The furnace aims at a uniform division of the magnetic forces, and at a relatively high degree of effectiveness combined with small size.

F. L. du Pont, in American patents 948372 and 950703, advocates the use of a rotating magnetic field. His furnace consists of a quartz tube surrounded by a water jacket and located between two rotating electromagnets. The electrodes are relatively near to each other, and the arc between them is kept in constant movement. Du Pont favors the use of compressed air at a pressure of 50 atmospheres.

The Dynamit Aktien-Gesellschaft, formerly Alfred Nobel & Co. (German patent 228849), proposes a furnace of quartz inclosed in glass of cylindrical form, with electrodes at the ends. Outside the

cylinder a number of rotating magnetic fields are located. They are in pairs on opposite sides of the cylinder. As a result of their action the arc produced between the electrodes is kept in constant rotation and follows a zigzag path along the walls and across the intervening space.

METHODS BASED ON SIMPLE ARCS.

While the features just given are all connected with the use of electromagnetic currents for enlarging the flame, the following are based on the use of simple arcs subject to the action of the air current employed.

PROPOSED BADISCHE IMPROVEMENTS.

The Badische Anilin- und Sodafabrik has proposed several improvements in the general process developed by Dr. Schönherr (German patents 201279, 204997, 212051, 212501, 227012, 238367, and 278368). Various modifications are proposed in the arrangement of electrodes and in the method of introducing the air current. The use of several arcs alongside each other is described, as well as the inclusion of several Schönherr tubes in a single furnace. In numerous directions the possibilities of increasing the effect of the arc and the economical utilization of the electrical force are studied in detail. Much variety is shown in the provisions for admitting the air current into the reaction chamber and for its withdrawal. The walls of the reaction tube, in one case, contain a multitude of perforations by means of which air enters and is withdrawn at every point the entire length of the arc. Currents of air moving in opposite directions are also employed. A tubular device is likewise outlined in which air enters in the middle of the tube and leaves at both ends. The ends are cooled with water jackets and electrodes are located in the two ends. Various modifications in the construction of the electrodes are proposed. Advantage is ascribed to the use of a hollow chilled electrode with perforations for the entrance of air through its terminal surface. A continual movement of the starting point of the arc from one point to another on the extremity of an electrode is thereby secured. This insures a certain economy of electrode carbon. In its German patent 227012 the "Badische" protects the use of chilled arcs with lowered pressure, as devised by Prof. Haber and already described.

SALPETER-INDUSTRIE-GESELLSCHAFT PATENTS.

The Salpeter-Industrie-Gesellschaft has likewise (German patents 213710 and 216090) proposed improvements that can be made in the Pauling process by introducing secondary high-tension circuits to bridge over the interval between electrodes and kindle arcs in a series, including a number of pairs of electrodes. An additional feature is the arrangement of two Pauling arcs, so that they unite to form a common flame. The special advantage is the automatic kindling of either arc in case it is accidentally extinguished. This company has also patented (German patent 235299) a device for suddenly reducing the pressure of the hot gas current issuing from an electric furnace, and thereby lowering the reaction velocity, and hence the rate

of decomposition, without lowering the temperature. The gas is cooled while under a pressure of a little over one-half of an atmosphere to the point where decomposition practically ceases, and then allowed to contract to the normal volume. The fundamental idea in this method is promising. It remains to be seen whether it can be used on an industrial scale. The inventors claim to be able to prevent all loss by reversion of NO to the elementary condition.

OTHER PROPOSED IMPROVEMENTS.

Dr. A. Scherbius (German patent 213709) describes an arrangement for securing the same effect by allowing the gas current to stream into a chamber of low pressure through a cooled nozzle. He proposes even to keep a turbine in motion by the aid of the current.

H. Howard (American patent 952248) follows much the same plan. Air is compressed, heated by the arc, and then allowed to expand suddenly. The energy is also utilized by means of a turbine.

D. Timar, of Berlin (German patent 223887), aims also at producing a rapid lowering of the temperature by similar means. He uses for the purpose a narrow cylinder of magnesia, which is introduced into an electrical circuit and thereby kept at a high temperature. Air enters at both ends of the tube, is heated as it slowly passes over the hot walls, and escapes through minute openings at the middle. The resultant expansion causes a very rapid and notable lowering of temperature.

P. Bunet and A. Badin (English patents 16224 and 16225; 1909) combine the use of divergent electrodes with a current of very high frequency—as much as 1,000 periods per second. They also employ a vertical electrode placed between two divergent electrodes.

The Chemische Fabrik Griesheim-Elektron (German patents 228422, 234591, and 235429) makes use of a series of horizontal arcs. Air is forced across the arcs from a number of slits in the roof of a furnace and rapidly removed from the zone of reaction.

Gebr. Burgdorf, of Altona (German patents 201279, 238367, and 238368), provide for the passage of air currents in opposite directions along Schönherr arcs by the admission of air between the electrodes, and its withdrawal at points adjacent to the electrodes. The methods adopted resemble closely those advocated by the "Badische" for the purpose.

Carl Rademacher & Co., of Prag-Carolinenthal (German patent appl. B. 55167, Kl. 12 h.), describe a method, also similar to one patented by the "Badische," for effecting a continual movement of the starting point of an arc from an electrode and thereby avoiding the rapid corrosion of the latter.

The Dynamit Aktien-Gesellschaft, vormals Alfred Nobel & Co., of Hamburg (German patents 211196 and 223366), proposes a cylindrical furnace with electrodes at the ends. Circles of nozzles for the entrance of air under slight pressure extend the whole length of the cylinder. They leave a narrow space in the center free, and this is traversed by the arc. Its location is not affected, as the air blasts are from all sides and of uniform force. The arrangement facilitates, however, a very intimate contact of all parts of the air current with the electric flame.

C. L. Garrard patented a device in 1907 consisting of a cylinder and a rotary arc (American patent 968145). The outlet for the gas was smaller than the inlet, so that the air was exposed to oxidation under increased pressure.

Prof. K. Kaiser (German patent 230042) claims that a distinct increase in the yield of NO can be obtained by introducing small amounts of ammonia into the current of air.

Kunheim & Co. (German patent 212881) have patented a furnace in which it is sought to eliminate the aureola of an electric arc between divergent electrodes by inserting the V-shaped arrangement characteristic of the Pauling device. No provision is made for rapid cooling.

The Electrochemische Werke G. m. b. H. (German patent 206948 and patent appl. C. 13895) describes a cylindrical furnace of large diameter and low form. Several electrodes are located at equal intervals in a plane, cutting the cylinder transversely in the middle. Air is introduced through tangential tubes, arranged one on each side of one of the electrodes in a pair. The current leaves through outlet tubes in the axis of the cylinder. As a result, the air current moves in a spiral from the periphery toward the center, and the arcs are expanded into a disk-shaped flame parallel to the spiral. In this and similar furnaces the attempt is made to secure a disk of flame by purely mechanical means without resorting to the aid of the somewhat costly electromagnetic field employed by Birkeland and Eyde.

The Zentral Stelle für Wissenschaftlich-Technische Untersuchungen G. m. b. H., of Neubabelsberg (German patent 211196) proposes a comparatively simple furnace. It consists of a narrow cylinder of porous material, or one the walls of which contain a multitude of minute openings or slits. Electrodes at the extremities of the cylinder generate a long arc. The reaction cylinder is inclosed in one of larger size into which air is forced. The air enters the inner chamber through the numerous openings along the whole length of the arc and issues from the ends. The arrangement prevents any too rapid chilling of the arc below the requisite temperature.

D. Helbig, of Rome (German patent 225239), has constructed a furnace in which rapid exposure of every part of the air current to a large surface of flame is attained. Three electrodes are used and are located in a narrow chamber at angles of 120° to one another. Air is admitted under pressure from two nozzles situated at opposite sides of the space occupied by the arcs. A 3-phase electric current is employed, so as to assure stability in the flame and in the consumption of electric energy. The flame wanders continually from one pair of electrode points to the next and is never fully extinguished. The air current, playing upon the axis from both sides, expands them into a wide sheet of flame. Dr. Helbig's experiments in 1903 on the oxidation of nitrogen in liquid air showed that the product yielded under these circumstances was nitrogen trioxide, N_2O_3 , a blue powder that melted at 111° C. to a deep-blue liquid.

Le Nitrogène, of Geneva (German patent 228423), introduces a device to guard against the extinguishing of arcs in nitrate furnaces in consequence of the too rapid draft of air. The tips of the electrodes are protected by screens of refractory material or are sunk in recesses of the furnace walls.

E. E. Werner described in 1904 (American patents 777990 and 777991) a furnace in which rapid cooling is effected by allowing air that has been compressed and cooled to escape through a nozzle immediately between the tips of the electrodes.

Schneller and Koeleman patented in 1903 a process based upon the use of the silent discharge, following up the experiments Siemens and Halske made in 1894.

OXIDATION WITHOUT AN ELECTRIC CURRENT.

While as a rule the inventors have sought to solve the problem in question by the aid of the electric current as a source of heat, not a few have studied the possibilities of attaining the end by other means. Any successful method based upon the use of ordinary combustible material would mean much for such countries as Great Britain and Germany, where water power is limited and necessarily costly. Experiments in this direction fall practically under two heads—the explosion of mixtures of combustible gases with air and the combustion of such gases in air.

HÄUSSER'S EXPERIMENTS.

F. Häusser, of Nuremberg (German patents 216518, 218813, and 232569), advocates the utilization of the high temperature attained in connection with the explosion of compressed gases for the production of mechanical energy, as in gas engines. For a very brief period in such an explosion a temperature of over $2,000^{\circ}$ C. is reached. The explosion is followed by a sudden expansion of the gas volume, and in consequence an equally sudden lowering of the temperature. These are two important essentials of the process as conducted with the aid of electricity.

Häusser's first experiments were conducted with air and coal gas, the latter forming 14.5 per cent of the mixture. Explosions were carried out in powerful bombs, and the temperature attained ranged from $1,800^{\circ}$ to $2,100^{\circ}$ C. The yield varied between 0.27 to 0.35 per cent of NO. These figures are very nearly equal to the equilibrium constants of Nernst for the temperature in question, and show a sound theoretical basis for the process. In his first patent the inventor describes the use of a compressing cylinder for the explosion. The cylinder is filled with the gas mixture, which enters through an automatic valve. A piston compresses it to a small volume, and the explosion is effected by a spark just before the piston reaches its limit. Automatically the hot gases enter into a cooling chamber. The piston retreats, sucking in a new volume of gas, and the operation can be maintained with great rapidity.

In order to render it technically feasible to work with so small percentages of NO, Häusser proposes to make use of gas engines, modifying the ordinary types slightly so that nitric oxide could be obtained regularly as a by-product in connection with their normal production of energy. The inventor's calculations in 1905 showed that the cost of making nitric acid in this manner, when not associated with the production of mechanical energy, would reach at least 40 cents per kilo of combined nitrogen. This figure is less than the cost of nitrogen in commercial nitric acid, but materially above its cost in the nitrates. The project is of decided interest. It

is doubtful, however, whether it is industrially practical to attach to establishments using the larger types of gas engines the requisite plant for the absorption of nitric acid from gases possessing so low a concentration. It would necessarily be quite large for a factory employing several thousand horsepower and the yearly output of nitrate or of acid could not exceed a few hundred tons.

In his later patents Häusser provides for conducting the gas mixture compressed in a single large cylinder into a number of bombs, where explosions take place. He also uses bombs of large size protected by insulating material, so that the high pressure and the elevated temperature are maintained for some time beyond that required for the reaction to reach the state of thermal equilibrium established by Jellinek's law. There is an assumption here that the shock of an explosion produces a series of molecular changes essentially different from those brought about by exclusively thermal action, and leading to different equilibrium constants, as Haber maintains to be the case also with purely electrical action. Häusser claims, in fact, that by using a mixture containing 10 per cent of illuminating gas in a bomb of 100 liters (106 quarts) he is able to secure a concentration of NO ranging from 1.3 to 1.7 per cent by prolonging the period of pressure and high temperature. According to Nernst's law, the normal temperature at the moment of thermal equilibrium would exceed but little 0.1 per cent. With such yields the reaction offers much of promise, and it is possible that the idea may eventually be of value industrially.

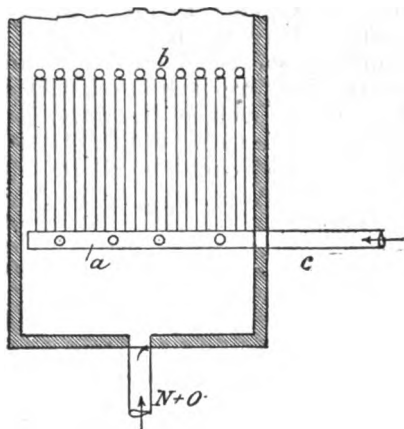
COMBUSTION OF HYDROGEN.

Since Bunsen showed the formation of nitric oxide on the explosion of hydrogen with air there have been numerous attempts to utilize the reaction as a source of combined nitrogen. Results of some promise have been secured when hydrogen is allowed to burn quietly in the air, preferably in a mixture of equal parts of nitrogen and oxygen. The yield is small under ordinary pressure. When the combustion takes place in gases that are highly compressed there is, however, a considerable formation of NO. Wolokitin, in Prof. Haber's laboratory, has found it possible, under such circumstances, to secure 3 molecules of nitric acid for every 100 molecules of water yielded by the combustion. This is equivalent to a yield of 2.1 pounds, in a combined form, for every 10 pounds of hydrogen employed. As the cheapest form of nitrogen now costs 6 cents per pound, direct utilization of the hydrogen flame in this manner is not at present commercially feasible.

COMBUSTION OF CARBON MONOXIDE.

A similar oxidation takes place, however, when other cheaper combustible gases are burned in the air. This is notably the case when carbon monoxide, CO, is employed. Prof. Haber has found that promising yields of NO can be secured when this gas is burned in air which is already heated and is under a pressure of eight to nine atmospheres. For every 100 molecules of CO burned, or of CO₂ produced, there are formed three or four molecules of NO. This yield is doubled when a mixture of equal volumes of nitrogen and

oxygen is employed in the place of air. As 100 volumes of CO can produce 4 volumes of NO by combustion in compressed air and 100 volumes of hydrogen can yield 3 volumes of NO, there is evidently a possible field for the employment of such very cheap sources as water gas (43 per cent CO and 48 per cent H) or Dowson gas (30 per cent CO and 15 per cent H). The latter gas, for example, costs in Germany 1 pfennig (\$0.00238) per cubic meter (35.314 cubic feet). The combustible constituents of 1 cubic meter, according to Haber's experiments, should yield 10.3 grams of nitrogen in a combined form. This means a cost for gas of 0.97 mark (\$0.23) per kilo of combined nitrogen. There is little difference between this figure and 1.15 marks (\$0.27), the present cost of nitrogen in the form of saltpeter, but it is sufficient to warrant a very close study of the possibilities of the process in various directions. The Badische Anilin- und Sodafabrik has patented a method in this connection (German patent 219494). Carbon monoxide burns in the form of a very narrow long flame in a tube through which compressed air or mixtures of air and nitrogen are conducted. The reaction gases, while still under pressure, pass through cooling tubes. Under these conditions liquid, and even solid nitrogen tetroxide, free from carbon dioxide, separate out. By admitting the proper amount of steam into the air current, or by using gases containing hydrogen or hydrocarbons, concentrated nitric acid is obtained directly.



COMBUSTION OF HYDROCARBONS.

O. Bender (German patents 192883, 206636, 217079, 217550, and 227490) has pushed investigations in this field so far that the method formulated by him for solving the problem has attracted much attention. He uses air alone, but also, as in other processes, preferably a mixture of air and oxygen. This is heated in a furnace to a high point and is exposed to the action of blasts of superheated steam. The temperature rises quickly in consequence of a sudden recombination of oxygen and hydrogen. Equally sudden cooling is effected by jets of colder steam. In later modifications, coal gas, water gas, and similar fuel gases are employed. The latter are conducted through a number of long, narrow tubes that are practically Bunsen burners. They are surrounded by the ascending current of the heated air, so that the temperature of the flame burning at their tips is very notably heightened. The reaction product contains NO alone and is quite free from nitric acid, despite the large amount of aqueous vapor present. The gas is dried before oxidation to NO₂, and the subsequent transformation to nitric acid in contact with water are attempted. Bender goes still further and car-

FIG. 5.—O. Bender furnace: a, Base of burners; b, tips of burners; c, entrance of fuel gas; d, entrance of air and oxygen.

ries out the oxidation of nitrogen in an ordinary generator furnace. The gas evolved by the action of air or steam on coke is burned immediately above the glowing coke with the aid of currents of oxygen or of nitrogen and oxygen. The oxygen currents are introduced in direct contact with the top layer of coke. In this manner a maximum temperature is attained. Sudden cooling and drying of the gas product is effected as already described. Bender claims that with his latest furnace he is able, when using a mixture of air and oxygen, to produce a gas containing 2.2 per cent of NO.

He finds further that the consumption of fuel necessary for the reaction amounts to 42 kilos of coal, possessing a thermal value of 7,000 calories, for each kilo of nitric acid. Allowing 10 marks (\$2.38) per metric ton for coal, which is a fairly high price, the outlay for fuel will amount to 0.042 mark (\$0.01) per kilo of nitric acid, or 0.30 mark (\$0.0714) per kilo of combined nitrogen. Should these figures hold good for manufacture on a large scale, there is evidently a large margin for other costs of manufacture and for the cost of added oxygen. Bender's process has been closely studied in Germany, where much importance is attached to the desirability of a domestic source of combined nitrogen. Although the water power of the Empire is limited, Germany is very rich in cheap fuels of low grade, such as lignite and peat. The gas generated by coking either of these is admirably adapted for the Bender process, and the fuel cost could in all probability be reduced to one-half of the amount above stated. Other inventors have improved the process in various details.

OTHER NONELECTRICAL PROCESSES.

Brünler and Kettler (German patent 185094) carry on the combustion in a chamber placed in a strongly built closed cylinder partly filled with water. Fuel gas and air are introduced into the chamber in such a manner as to secure intimate mixture and complete combustion. The reaction products pass immediately into water before escaping into the outer air. In this manner a solution of nitric acid is obtained, which is drawn off from time to time. The experience of Bender and others would indicate that only a certain portion of the NO formed in the combustion chamber can be secured by passing the hot gases immediately through water. In a later modification (German patent 209961) Kettler operates as follows: A furnace is fed with fuel gases or vapors mixed with air and maintained at a temperature of 1,200° to 1,300° C. A coil of platinum or porcelain pipe passes through the furnace; on leaving the furnace it is heated to 2,000° by a benzine-oxygen flame. Air or air and oxygen are conducted through the pipe and issue from it into an acetylene-oxygen blast that raises the temperature still higher. The reaction products are directed through a cooler inclosed by water and traversed by jets of water or alkaline absorbents.

The use of catalytic agents in the reaction is favored by Baron von Vietinghoff-Scheel (German patent 222629), who brings them into the flame in the form of a powder or vapor. Calcium and sodium fluoride are strongly recommended, but metals and metallic oxides, and even such compounds as silicon chloride and nickel carbonyl, are effective. The purpose is to prolong and intensify the action of heat,

necessarily slow and limited within the range of temperatures attained by the combustion of hydrocarbons and the like.

K. Södermann (German patent 418117) uses similar agencies and secures an increased yield by a blast of acetylene into the oxidizing flame.

H. O. Pfennig's heirs (German patent 229142) mix the hot gases resulting from the combustion of hydrocarbons with compressed air or oxygen, previously strongly heated, and force the mixture through slit burners into a furnace chamber.

R. Pawlikowski (German patents 171623 and 225195) makes use of alternating pressure and expansion. Combustion is brought about while under pressure, very much as in the Häusser process, while a blast of cold gas enters the reaction chamber at the moment of expansion.

F. A. H. Wielgolanski (Norwegian patent 20328) introduces a somewhat novel feature. Air is heated to $1,500^{\circ}$ – $1,700^{\circ}$ C. It is then suddenly mixed with nitrogen dioxide, NO_2 , which has been previously heated to 500° , and the mixture is cooled to $1,200^{\circ}$. It is claimed that under these conditions the nascent oxygen liberated by the NO_2 is able to oxidize a certain amount of atmospheric nitrogen.

Finally, mention should be made of the claim by Marston, as far back as 1900 (English patent 19074), that NO could be produced by conducting air containing ammonia or hydrogen over glowing copper, iron, or other metals.

While no distinct technical triumph has yet been gained by any of the inventors who have sought to effect the oxidation of atmospheric nitrogen without the aid of the electric current, there is a strong feeling, especially in Germany, that the problem may be solved along some one of the lines just described. The feeling finds its strongest expression in connection with Bender's method and with the process involving the burning of carbon monoxide and similar gases in compressed air.

METHODS OF UTILIZING NITRIC OXIDE.

THEORETICAL STUDIES.

Passing from the review of the many projects for effecting the oxidation of atmospheric nitrogen under the most profitable conditions, it is desirable to note what progress has been made in the methods for bringing the uniform reaction product—nitric oxide—most advantageously into current commercial forms.

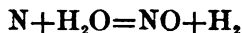
Contemporaneously with the multitude of studies regarding the production of NO , there have been almost equally varied efforts aiming at a simplification of the vast absorption plants, and at a more diversified and profitable utilization of the intermediary product.

In connection with these technical studies, additional light has been thrown upon the chemical changes which occur after the reaction gases leave an electric furnace. They have been very clearly summarized by Prof. Guye, and may be stated briefly here.

EFFECT OF MOISTURE IN AIR.

Thus far air has been used in the nitrogen furnaces without previous drying. The aqueous vapor naturally undergoes dissociation

at the temperature of the electric arc, forming free hydrogen and oxygen. It is even possible that a slight amount of NO is formed, according to the equation:



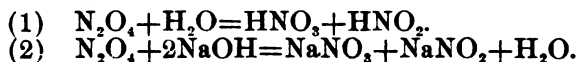
This reaction, like that of the dissociation of water, is, however, reversible. On cooling the free hydrogen can combine with oxygen again to form water, or can reduce nitric oxide, liberating nitrogen. The experiments of Guye tend to show that this latter reaction preponderates, and that a certain amount of NO formed in the arc may be reduced in consequence of this fact. Guye finds that there is a perceptible increase in the yield when the current of air employed is freed from moisture before entering the furnace.

OXIDES OF NITROGEN IN THE COOLED GASES.

As the temperature falls below 600° the oxidation of NO to NO₂ commences. Below 140° NO₂ begins to polymerize and change into N₂O₄. There seems to be a slight formation of N₂O₃ in this connection— $\text{NO} + \text{NO}_2 = \text{N}_2\text{O}_3$. When ordinary temperatures are reached the gases attain a stage of equilibrium in which N₂O₄, NO₂, NO, and probably a small amount of N₂O₃ are all present with the free oxygen and nitrogen of the air. When the total percentage of oxide of nitrogen (calculated as NO) amounts to 1 per cent of the gas volume, nitric oxide forms from 10 to 20 per cent of the total. Of the remaining 80 to 90 per cent of nitrogen peroxide, nine-tenths are in the form of NO₂ and one-tenth in the form of N₂O₄. It is in dealing with such small percentages of a given oxide in an air current that the chemist encounters his chief difficulty in bringing about a fairly complete absorption in a technical form. Thus, if NO constitutes 0.1 per cent of the volume of a gas and undergoes oxidation to N₂O₄ or NO₂ until but 0.01 per cent remains, the rapidity of oxidation is then 1,000 times less than it was at the outset. The advantage of compressing the reaction gases then becomes evident, as the speed of oxidation can be notably heightened thereby.

REACTIONS WITH ABSORBENTS.

In the process of absorption now employed, when the cooled furnace gases come into contact with water or alkaline solutions the fraction of N₂O₄ present reacts:

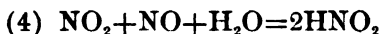


In either case a fresh quantity of NO₂ changes to N₂O₄ to establish equilibrium. In reaction (2), when the caustic alkali is completely neutralized, if the gas current continues to pass through the solution the nitrite is gradually decomposed by the resultant free nitric acid until finally a solution of nearly pure nitrate is obtained. In reaction (1) the nitrous acid formed decomposes to nitric acid and NO, thus:



The NO thus liberated passes through the same cycle of changes. Logically, it would seem that finally there should be a complete

absorption of the combined nitrogen present in the form of nitric acid, but practically this result has not been attained, for when the dilution of the gas reaches a certain point N_2O_4 can no longer exist and is dissociated into NO_2 . Absorption can then take place in the form of nitrous acid:



Reaction (3) then follows. Calculation shows that if the cycle of changes indicated in equations (1) or (2) and (3) is followed it must be repeated four times to secure the absorption of 99 per cent of the NO originally present. If the reactions indicated by (4) and (3) prevail nine cycles, on the contrary, would be necessary to attain the same result. This emphasizes the desirability of securing so far as possible absorption by means of the tetroxide, N_2O_4 , and of shaping temperature, pressure, etc., to this end. The above reactions explain also why the "tailings" of the gas current after leaving the main absorption towers yield nitrite almost entirely when conducted into alkaline solutions. No N_2O_4 is present, and reaction (4) alone comes into play. There would appear to be a certain quantity of nitrite formed at this stage by the action



This formation of N_2O means a loss of combined nitrogen, as nitrous oxide is totally unable to take up oxygen under the conditions of absorption, and escapes into the air. It is probably due to this subsidiary reaction that it has thus far been impossible to obtain by absorption in various forms all of the combined nitrogen shown by analysis to be present in the current of gas issuing from an electric furnace, even if the absorption be carried so far that every trace of NO and NO_2 is removed.

D. F. Förster and J. Blick have recently shown that mixtures of equal volumes of NO and NO_2 act essentially as N_2O_3 , and that the latter is much more rapidly absorbed by alkalis than N_2O_4 .

EXPERIMENTS IN ABSORPTION METHODS.

ADVANTAGES OF COMPRESSION.

Various attempts have been made to utilize industrially the knowledge of the series of reactions outlined above.

The principle of absorption while the gases are under pressure has been patented by Naville, Guye, and Guye (French patents 385569 and 385605), by K. von Vietinghoff-Scheel (German patent 225706) and by F. Bergius (German patent appl. B. 53617). They find that not only is the reaction more rapid, but that it is possible to secure a more highly concentrated acid than by the existing method.

Bergius employs a pressure of 25 atmospheres, and adds to the gas current just enough water or steam to form nitric acid. The compressed gas passes through a heated reaction chamber and is liberated from pressure on entering a condensation chamber. Here the nitric acid separates out and is drawn off with the slight amount of water resulting from its disassociation in the heated reaction chamber. The mechanical difficulties in the way of using pressure

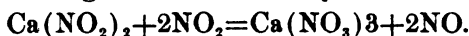
in handling such large volumes of gases seems to have discouraged an industrial application of the principle.

DIRECT MANUFACTURE OF NITRITE AND NITRATE.

The possibility of doing away entirely with the gigantic absorption towers and of securing combined nitrogen at once, in the form of nitrate or nitrite, without having recourse to the intermediary formation of nitric acid, taxes the ingenuity of technical chemists.

If a nitrite, such as sodium nitrite, could be made the chief product of manufacture, the problem would be vastly simplified. The gases issuing from the furnaces can be cooled down to 200° to 300° C., when about one-half of the NO present has been oxidized to NO₂, and in this condition they can be led directly into the solution of an alkaline carbonate, such as sodium carbonate, or of an alkaline hydroxide, such as caustic soda. Reaction (4), page 99, here becomes effective and a nitrite is produced perfectly free from nitrate. The "Badische" has adopted this method for the production of sodium nitrite in its small plant at Christiansand, with signal success.

It has gone still further and studied carefully the practicability of replacing water as an absorbent by milk of lime. It is possible to obtain from the first tower of a series a solution of calcium nitrate free from nitrite. Smaller towers can be used and they can be constructed of iron, thus avoiding the large outlay for the establishment of granite towers. A still smaller tower will suffice if the absorption be confined to securing a mixture of nitrate and nitrite in solution. After evaporation the mixture of calcium nitrate and calcium nitrite can be changed to nitrate by exposing the salts to the action of the hot gas current coming from the furnaces, thus:



The favorable temperature for this change is 300° C. The current containing NO is directed to the main oxidizing and absorption plant.

In connection with this reaction it has been found advantageous (German patents 233967 and 233982) to force the liquid into the gas current in the form of spray. This prevents a certain accumulation of slime and a clogging of the absorption system that is apt to occur when milk of lime trickles over the usual filling of a tower. The spray is introduced through openings arranged tangentially to the base of a cylinder traversed by the gas current. The bottom of the spraying device is of glass. The tangential arrangement produces a vortical movement in the gas column. As viewed through the glass, this gives the appearance of a dark disk. Changes in the size of this disk indicate alterations in the rate of absorption.

A complete avoidance of liquid absorption has likewise been attempted by the "Badische" (German patent 210167). Steam is introduced into the hot gas current in barely sufficient amount to accord with the reaction changing the combined nitrogen into nitric acid and nitrous acid. The current is then directed over lime or caustic alkalies in the solid form. Slaked lime, calcium carbonate, and the alkaline carbonates are also available. A powerful reaction ensues. There is a very rapid absorption and reoxidation of liberated NO. The chief product is nitrate in the solid form. An important condition is to maintain the temperature well above the boiling point of water, and the best results are obtained by the use of absorbents in a powdered form.

PRODUCTION OF MAGNESIUM NITRATE.

Very satisfactory results (German patent 232926) have been secured by using magnesia, its hydroxide, or magnesium carbonate. The temperature can be maintained at a point at which the dissociation tension of magnesium nitrate is very slight, but at which magnesium nitrite can not exist. It seems possible to prepare in this way a fairly pure magnesium nitrate, and to utilize easily very dilute concentrations of NO. This process offers one distinct advantage: In the form of magnesium nitrate it is possible to store up nitric acid in a fairly concentrated form, and in a convenient shape for transportation at comparatively slight expense. Magnesite is a very cheap mineral, and magnesium nitrate contains nearly 20 per cent of nitrogen. When treated with sulphuric acid 100 pounds of magnesium nitrate yield 87 pounds of pure nitric acid. It is therefore well adapted for use in transporting combined nitrogen over long distances to industrial centers, where it is in demand for the production of nitric acid. There is one drawback in this connection that must not be overlooked: The residues of magnesium sulphate are not so easily withdrawn from a retort as are those of sodium sulphate. Calcium nitrate has the same disadvantage.

The availability of magnesia, and also of such substances as the oxides of copper, lead, and zinc, for absorbing nitrogen peroxide, has been recognized by the Elektrochemische Werke (German patent 212423). In the form of powder all of these oxides absorb rapidly and completely if stirred constantly. The resultant neutral salts are easily decomposed at 500° C. Pure nitric acid, of any desired degree of concentration, or fuming nitric acid can be secured from them by the customary methods of heating with sulphuric acid or of dry distillation.

SLAKED LIME AS AN ABSORBENT—SCHLÖRS'S ABSORBENTS.

The French chemist Schlösing has obtained interesting results in the use of slaked lime as an absorbent. He employed lime of a light, porous quality free from hard lumps. When thoroughly slaked, it was molded into balls or briquets, and these were dried at a low heat. The furnace gases on passing through chambers filled with such briquets, and kept at a temperature of 300° to 350° C., rapidly lose their nitrogen peroxide. The final result is solid calcium nitrate containing 15 per cent of nitrogen; it gives a slight alkaline reaction and shows a trace of nitrite.

C. C. Schlörb (French patent 422751) advocates the use of the oxides or basic nitrates of iron, aluminum, or chromium for the absorption of nitrogen peroxide; they may be employed alone or in combination with lime or caustic alkalies, and in moist condition. He obtains in this manner lyes containing as much as 80 per cent of HNO₃. Nitric acid of varying strength is secured from such lyes by distillation, and the residues are available for repeated use as absorbents.

COST WITH PRINCIPAL SALTS.

In connection with the above methods of securing combined nitrogen in the form of different nitrates, it is interesting to note the variation in cost dependent on which of the leading salts is used.

Klaudy, in basing the cost of electric power at \$5 per kilowatt year, and including in his estimate only this item and that of raw materials (lime, soda, and magnesia), finds that the cost of 1 kilo of nitrogen in the form of calcium nitrate is 8.6 cents, in the form of magnesium nitrate 12.1 cents, and in the form of sodium nitrate 15.2 cents.

As yet none of these methods of absorption has proved distinctly its economic advantage over the use of water, as is seen from the fact that the large new works at Saaheim are equipped with imposing granite towers similar to those erected at Notodden. That there are, however, great possibilities of simplifying the process and rendering it more economical can not be denied.

The present concentration of the Norwegian works on the output of nitric acid for use in making ammonium nitrate may have influenced the decision at Saaheim, and the existence of the towers does not preclude the adoption later of simpler means to produce the nitrates.

ADVANTAGES OF CALCIUM NITRITE.

It is considered that the most promising field lies in the production of calcium nitrite on a large scale. Absorption of the gases while still hot, and while the combined nitrogen is practically in the form of N_2O_3 , means a pronounced economy in various directions. It has now been clearly shown that nitrogen in the form of nitrite possesses the same value for fertilizing purposes as in the form of nitrate. If its use for the purpose could be generally recognized there would be a manifest advantage in its employment. The anhydrous salt contains 21 per cent of nitrogen, so that in the matter of transportation a very notable degree of economy would be attained.

The ease also with which solutions of nitrite can be further oxidized to nitrate, by continued action of the gas current containing nitrogen peroxide, gives additional importance to this method of capturing the product of the electric furnace when it is not necessary to secure it in the form of acid.

Important also, in this connection, are the processes developed by the "Badische" (German patents 220539, 223026, and 223556), based upon the decomposition of nitrites in solution by the addition of the requisite amount of nitric acid to change them into nitrates. The liberated N_2O_3 is added to the current of furnace gases to undergo further oxidation.

ABSORBENT PROPERTIES OF CHARCOAL.

An ingenious method for withdrawing the oxides of nitrogen from the gas current and obtaining them in a concentrated form has been devised by the Farbenfabriken, vormals Fr. Baeyer (German patent 228426). Use is made of the marked absorbent properties of charcoal for nitrogen peroxide. By passing gas currents containing even very low concentrations through layers of charcoal it is possible to absorb nearly all of the oxide present. When the current contains 3 per cent of oxide 100 pounds of charcoal absorb an amount of oxide equivalent to 12.2 pounds of nitric acid. With 5 per cent of oxide in the current the yield reaches 17 pounds of nitric acid. The absorbed gas is driven out of the charcoal by means of a vacuum, or by the use of hot air, inert gases, or dry steam under pressure. Pref-

erence is given to the last mentioned. The oxide is thus liberated in a very concentrated form, allowing of rapid absorption. The inventors of the method do not claim, however, to recover more than 80 per cent of the oxide thus absorbed, so that for the present at least it is not of much commercial importance.

OTHER EXPERIMENTS.

Other means have been proposed for withdrawing peroxide from its mixture with air. The company Le Nitrogène (French patents 421022 and 421313) advocates the use of special solvents combined with low temperatures. The gas current is passed through refrigerating chambers with temperatures ranging from 0° to 50° C., and brought in contact with such liquids as carbon tetrachloride, chloroform, or ethyl pentachloride (C_2HCl_5). These liquids absorb N_2O_4 very rapidly. They do not congeal above -50° C. nor boil below $+50^{\circ}$ C., so that it is easy to expel the dissolved gas in a highly concentrated form. The presence in the gas of finely divided carbon, especially bone black, facilitates solution at a higher temperature than is otherwise readily feasible. The use of a low temperature alone, such as is obtained by alternate compression and expansion, as practiced in the present forms of apparatus for the liquefaction of air, can also be used to advantage. From a gas current containing 1 per cent NO on issuing from the furnace it is possible in this manner to isolate 90 per cent of the combined nitrogen present as liquid or solid peroxide. There is an advantage in freeing the air current at the outset from moisture and carbon dioxide. The partial use of one of the above-mentioned solvents is also recommended. The chief difficulty to be encountered in isolating nitrogen peroxide by means of refrigeration lies in the fact that the percentage in the gas current is very small and the partial pressure of the oxide very slight. As a result complete liquefaction involves the use of very low temperatures at a cost that would be prohibitory. Thus, in a gas containing 0.5 per cent of NO_2 it would be necessary to cool the entire volume to about 100° C. in order to secure 99 per cent of the peroxide in the form of N_2O_4 . Sir William Ramsay has studied this phase of the problem, and even taken out a patent (English patent 28981; 1907) for combining such a refrigeration with the liquefaction of air and the separation of oxygen to use in enriching the air current entering a nitrate furnace, so that it may consist of equal volumes of the two gases.

Prof. Guye has made experiments in this connection that show that liquid N_2O_3 when mixed with liquid N_2O_4 , as is probably the case in liquefying the products of the electric furnace, is readily converted to the form of the tetroxide by the passage of a current of oxygen. Conversely, liquid N_2O_4 is promptly changed to N_2O_3 by the passage of a current of NO. An important result of his investigations is the establishing of the fact that liquid N_2O_3 and N_2O_4 , when free from water, do not attack ordinary metals in the slightest degree. This would render their use on an industrial scale exceedingly simple as far as apparatus is concerned. They fall into the same category as chlorine and carbonyl chloride, which are now used so extensively as commercial products.

TECHNICAL USES OF NITROGEN PEROXIDE.

Any modification of the nitrate industry permitting the economical preparation of N_2O_4 on a large technical scale would probably be of great importance in the manufacture of high explosives. It is possible to prepare mixtures of N_2O_4 and various organic compounds that possess enormous explosive power; such mixtures would rival nitroglycerin in many ways.

Not only in this connection but in other fields there are important possibilities of utilizing the immediate products of the oxidation of atmospheric nitrogen, without attempting their absorption in the form of nitric acid, nitrates, or nitrites.

FURNACE GAS IN SULPHURIC-ACID MANUFACTURE.

It has been suggested that the gas current could be employed advantageously in the place of nitric acid for effecting the series of changes in the lead chambers of sulphuric-acid works. Under existing conditions it does not seem feasible to attempt the direct use of the gas for this purpose. Klaudy has made a valuable study of this subject and a summary of his results are here given. In the best acid works there is a consumption of 0.7 kilo (1.54 pounds) of Chile saltpeter, $NaNO_3$, for every 100 kilos (220.46 pounds) of pure sulphuric acid produced. This is equivalent to 379 grams of NO_2 , and corresponds to 10 cubic meters (353.14 cubic feet) of the furnace gas carrying 2 per cent of NO_2 . As 100 kilos of sulphuric acid require a chamber space of 40 cubic meters (1,412.58 cubic feet) under favorable conditions, the dilution of the gas by the addition of 10 cubic meters of air would interfere seriously with the normal course of the reaction. Furnace gas must attain a concentration of at least 5 per cent NO_2 before it can be safely admitted into the lead chambers. It is possible, however, to absorb NO_2 by means of sulphuric acid and employ the nitrosyl-sulphuric acid thus obtained in the Glover tower of acid works. It is even possible by direct mixture of SO_2 and water with the nitric gas current to secure nitrosyl-sulphuric acid in the form of crystals or a concentrated solution, a form which adapts itself easily to the requisite analytical control of the process. B. T. Halvorsen (Norwegian patent 15021) and Dr. Birger and F. Halvorsen (Norwegian patent 14831) have worked out the details of this method. This proposed utilization of nitric furnace gas seems to offer very pronounced economies over the present use of saltpeter. Large acid works with about 10,000 cubic meters of chamber space, and producing daily 250 tons of sulphuric acid, consume daily about 175 kilos of saltpeter, worth \$7.90. The equivalent amount of nitric furnace gas would cost only \$1.05, based on a cost of \$4.75 per kilowatt year. It is obvious that the cost of electric power could be trebled or quadrupled and still leave a large margin of daily profit.

AMMONIA AND CAUSTIC ALKALIES.

G. E. Cassel (Swedish patent 18229) proposes to utilize the solution of mixed calcium nitrate and nitrite resulting from the absorption of the furnace gases in milk of lime as a source of ammonia and of caustic alkali. The solution is treated with an alkaline carbonate

or sulphate and changed into a solution of sodium or potassium nitrate and nitrite. It is thus introduced into an electrolytic apparatus and decomposed. Ammonia is generated at the cathode and can be collected; caustic alkali remains in solution. This can be used repeatedly for absorption purposes, while the ammonia can be employed for the manufacture of ammonium nitrate. Oxygen generated at the anode can be utilized to enrich the air current entering the furnaces.

UTILIZATION OF NITRIC ACID.

CONCENTRATION.

The current method of manufacturing synthetic nitric acid yields a somewhat dilute acid—50 per cent at the highest. For a number of important purposes, such as the manufacture of nitroglycerin, an acid of over 90 per cent is required, while for other purposes an acid of at least 60 per cent HNO_3 is needed.

Pauling's electrolytic method for obtaining more concentrated nitric acid, as well as the methods based on distillation alone, or with sulphuric acid, have already been described (p. 69). It remains to note a few other processes intended more directly for use with synthetic acid. Reference has already been made to the means of securing at the outset a concentrated acid by carrying on the absorption under pressure—a method presenting for the time being serious mechanical difficulties.

Dr. E. Brauer (German patent 222680) starts with 65 per cent acid, the highest concentration secured by ordinary fractional distillation, and uses phosphoric acid or arsenic acid as a dehydrating agent. On heating, 86 per cent of the entire amount of nitric acid is secured in a concentration of 94 per cent HNO_3 . The first fraction even contains 97 per cent. The remainder of the acid is obtained in a concentration of 47 per cent.

O. Dffenbach and C. Uebel (German patent 238370) follow much the same plan. They employ pyrophosphoric acid and metaphosphoric acid, and the corresponding forms of arsenic acid as well as their acid salts, and obtain nitric acid of the highest possible concentration. The residual orthophosphoric acid readily gives off water on raising the temperature, and reverts to the forms originally used.

I. Moscicki (German patent 230170) uses the hot gas current from a nitrate furnace in a very effective manner. The 40 per cent acid ordinarily obtained from the absorption towers is mixed with sulphuric acid of 61° Baumé. This mixture descends through an ordinary tower and is met by an ascending current of furnace gas ranging in temperature from 50° to 60° C. As a result, all of the nitric acid present is volatilized at a temperature far below its natural boiling point and is easily condensed in a very concentrated form. The dilute sulphuric acid drawn off at the bottom of the tower is concentrated to 61° Baumé (80 per cent) in lead pans and employed again and again. The manifest advantage of this process lies in the use of a moderately concentrated sulphuric acid. There is hence no need of platinum vessels to carry on the repeated evaporations. The amount of sulphuric acid is likewise materially less than by the method hitherto in vogue.

Nathan, Thomson, and Nathan altered the customary arrangement of condensing coils for the distillation of nitric acid. (French patents 406806.) The vapors enter from below and condensed acid flows backward, to be drawn off at the base of the coil, which is the hottest portion. Through an opening at the top of the coil the liberated oxides of nitrogen are withdrawn by suction. The device yields an acid almost free from the lower oxides.

C. Uebel (German patent 210803) modifies the operation based upon the distillation of dilute nitric acid with strong sulphuric acid, dividing it into two stages. At first dilute nitric acid is distilled with moderately strong sulphuric acid. The resultant distillate, an acid of 75 per cent, is then heated at a materially lower temperature with an 80 per cent sulphuric acid. This yields directly nitric acid of 90 per cent, which can be raised to 96 or 98 per cent with the aid of a dephlegmator. The weakened sulphuric acid remaining from the second distillation is employed for the first stage and then concentrated by evaporation to its original strength.

The Swedish Nitric Syndicate has perfected a method for the continuous concentration of weak acid at relatively low temperatures with the aid of sulphuric acid. (German patent 236341.) An acid-proof tower contains the usual filling of quartz, over which the mixture of strong sulphuric acid and weak nitric acid descends. The tower is heated externally, and at the same time the interior is traversed by an ascending column of hot gases. Air for this purpose may be heated in the ovens supplying heat for the outer walls of the tower or the products of combustion from the ovens may be employed. The arrangement permits economic utilization of the fuel used, while a large proportion of the nitric acid is distilled below its normal boiling point.

The Salpetersäure-Industrie-Gesellschaft (German patent appl. S. 30557) passes the vapors yielded by the distillation of 60 per cent nitric acid through such dehydrating agents as the polysulphates, phosphoric anhydride, etc. Provision is made to maintain the temperature of the materials used sufficiently high to prevent any condensation of the acid vapors. Special processes for liberating nitric acid from calcium nitrate have likewise been perfected.

The Chemische Werke, vormals H. Byk (German patent 208143; patent appl. C. 17106), digest the salt with concentrated sulphuric acid under constant agitation for some hours at 100° C. The liberated nitric acid is separated from the residue of calcium sulphate by the use of a filter press or a centrifugal. It is found advantageous to secure an acid of 59 per cent by this process. When higher concentration is attempted much of the calcium sulphate is formed in the anhydrous condition. A process very similar to the above has been devised by Boeters and Wolfenstein (German patent 189865).

The same inventors advocate also the use of anhydrous calcium nitrate as a dehydrating agent. This salt adapts itself admirably for the purpose in view, as the regeneration of the anhydrous compound can be effected so easily in the nitrate works by the aid of the heat given off from the furnace gases. Prof. Guye finds that 40 per cent nitric acid can readily be changed to 95 per cent acid by using calcium nitrate, and that the best results are secured when distillation is carried on in two separate operations. There is scarcely any loss through the evolution of oxides of nitrogen.

The "Badische" (German patent 227377) has devised a continuous system, using a series of distillation chambers that facilitate the production of nitric acid of any desired strength or degree of purity. The arrangement is such as to prevent foaming in the vessels containing sulphuric acid and nitrates, and to obviate all danger of the stoppage of the pipes.

H. Schellhaus (German patent 241711) proposes to introduce sulphuric acid in the form of spray and finely powdered nitrate, both separately heated in advance, into a retort chamber kept at the proper temperature. Molecular quantities of salt and acid are employed. Under these conditions the amount of sulphuric acid is greatly reduced and there is no heating of the nitric acid and its consequent decomposition with formation of red fuming acid. A single reaction tower is required. With the use of sodium nitrate it is possible by this process to secure neutral sulphate as a residual product instead of bisulphate.

DIRECT USE OF DILUTE ACID.

Various experiments have been made involving the direct use of the dilute nitric acid in the manufacture of other chemical compounds. The Elektrische Werke G. m. b. H. (German patent 233895) proposes to use it as the starting point for the production of ammonium nitrate by electrolysis. An electrolytic apparatus with diaphragm cells and aluminum cathode is employed, and the operation is conducted at ordinary temperatures. At the outset a solution containing 30 per cent of nitric acid and 5 per cent of ammonium nitrate is introduced. Reduction takes place in the cathode cell, one-half of the acid being transformed into ammonia by the formation of ammonium nitrate. Fresh acid is added to the cell until the solution contains 40 per cent of NH_4NO_3 , when it is withdrawn for evaporation. In order to neutralize the disturbing action of nascent oxygen it is desirable to add nitrous acid to the anode cell. This process is naturally dependent upon a supply of very cheap electricity. It is doubtful whether, under the existing conditions, it can compete successfully with the method for manufacturing ammonium nitrate already installed at Notodden, for which ammonia solution is brought by water from England.

NITRIC ACID IN THE MANUFACTURE OF SUPERPHOSPHATES.

Much more promise is offered in the projects to employ synthetic nitric acid as a substitute for sulphuric acid in the manufacture of superphosphates. J. Coignet, in 1897 (French patent 272534 and addition of Feb. 15, 1898), outlined the details of such a process. The product of the reaction is a mixture of calcium nitrate, with monocalcium phosphate and dicalcium phosphate, and is obviously an admirable fertilizer. As natural mineral phosphates are abundant in Norway and form an article of exportation, it would seem that the manufacture of such a compound fertilizer could be added most advantageously to the prospective field of activity of the newly established works.

It may not be necessary even to produce nitric acid for such a purpose. Schlutius, and later Prof. Guye, have shown that powdered phosphates are decomposed by the direct action of the hot gases from

an electrical furnace. A mixture of calcium nitrate and calcium nitrite is at first formed, while tricalcium phosphate passes successively into the forms of dicalcium phosphate and then of monocalcium phosphate. Prolonged exposure to the current of furnace gas changes the nitrite into nitrate. There is here another possibility of the direct utilization of the furnace gas without the use of absorption towers.

Prof. Guye proposes also (Swiss patent 44223) the use for this purpose of the nitrosyl-sulphuric acid HSO_5N , obtained by passing the furnace gases through sulphuric acid. If the latter operation is continued to the point of complete saturation, a solid mass is obtained consisting of a mixture of nitric acid with nitrosyl-sulphuric acid. This can be employed, not only in the Glover tower of the sulphuric-acid works, as already indicated, but also for the production of superphosphate.

MANUFACTURE OF ALKALINE NITRATES.

There is an excellent field for the use of the dilute synthetic acid in the preparation of the pure alkaline nitrates, KNO_3 and NaNO_3 , as required in the arts.

Potassium nitrate, apart from the saltpeter export of India, is almost universally prepared at present by the "conversion" process, in which natural potassium chloride reacts in solution with Chile saltpeter. Prof. Jurisch proposes to add dilute synthetic nitric acid directly to a mixture, in equivalent proportions, of potassium chloride and limestone, both finely powdered. The reaction would be:



The resultant solution yields pure saltpeter from a single crystallization. By a similar reaction with ordinary salt, NaCl , pure sodium nitrate can be secured.

Both operations could be simplified by conducting the gas current from an electric furnace into dilute solutions of either of the alkaline chlorides as absorbents instead of water, and then adding the resultant acid liquor to limestone. If it were deemed desirable to save the chlorine contained originally in the alkaline salts, recourse must be had to magnesite instead of limestone. The residual liquors in this case contain magnesium chloride, MgCl_2 , and this can serve as material for the manufacture of chlorine and of hydrochloric acid by the method now used at Neustassfurt and at Leopoldshall.

Prof. Guye informs me that he has perfected a process by which it is possible to change quantitatively salt and dilute nitric acid into sodium nitrate and hydrochloric acid. Potassium chloride can be substituted for the sodium salt and gives equally good results. He has also succeeded in bringing about the same reaction between nitric acid and calcium chloride, although the yield in this case is but 85 per cent of the theoretical.

UTILIZATION OF WASTE CALCIUM CHLORIDE.

Le Nitrogène, of Geneva (German patent 242014), has incorporated the methods of Prof. Guye in a general patent. The essential conditions for success are dilution, low temperature, and low pressure.

It is found advisable to use acid containing at the most 35 per cent of HNO_3 . The temperature is kept below 80°C ., and distillation is carried on under a pressure not exceeding 300 millimeters (11.811 inches) of mercury, or two-fifths of an atmosphere. The volatile products are condensed in chambers containing solid chlorides. Attempts hitherto to employ the chlorides of the alkaline and earth alkaline metals for the production of nitrates and hydrochloric acid have failed for two reasons. It was necessary to evaporate the salts several times with an excess of nitric acid, and the operations were accompanied by a serious evolution of chlorine and of nitrosyl-chlorine, as a result of the familiar reaction:



By observing the above-mentioned conditions, this reaction is almost entirely eliminated. There is, apparently, a prospect here for the eventual utilization of the enormous quantities of calcium chloride, the only by-product in the Solway soda process that is at present totally without value. The reaction may assume great importance later on, and exert considerable influence in molding the future of the soda industry. The electrolytic production of caustic soda and chlorine has dealt a blow to the Leblanc soda process. Should the Guye method of producing hydrochloric acid in connection with the nitrates, by the aid of either salt or calcium chloride, prove to be a technical success, it would sound the death knell of the time-honored industry.

OTHER POSSIBILITIES.

The question naturally arises here whether the mineral chlorides of Stassfurt could not be more advantageously employed for the purpose of manufacturing hydrochloric acid than either salt or the calcium chloride waste of the Solway process. The potassium chloride furnished by the Stassfurt works is obtained from carnallite and contains ordinarily 80 per cent of KCl , but higher grades are also secured. At slight expense this potassium chloride could be transported to nitrate works and transformed into potassium nitrate and hydrochloric acid. This potassium nitrate could in turn be used directly as a fertilizer, and more especially as a combined nitrogen-potash constituent of mixed fertilizers. As normal saltpeter is not hygroscopic, it would probably present little of the inconvenience attending the use of Chile saltpeter for mixed fertilizers.

An ideal combination might be attained by using for mixed fertilizers a superphosphate prepared by the aid of nitric acid. There would then be no danger of suffering a loss through the action of free sulphuric acid on nitrates. Such a branch of manufacture could easily be developed wherever transportation conditions favor the bringing together, at a minimum cost, of nitric acid and potassium chloride. The cheap production of potassium nitrate in this manner would necessarily be limited by the current demand for hydrochloric acid, but any considerable manufacture of potassium saltpeter for use in agriculture would be an important event in heavy chemical industries. Germany produces annually over 300,000 metric tons of hydrochloric acid. The annual production in the United States in 1905 was 94,000 short tons.

UTILIZATION OF CALCIUM NITRATE.

Calcium nitrate is at present the cheapest and simplest form in which combined nitrogen, as obtained from air by the oxidation process, can be secured in a solid merchantable form. Primarily it is intended for use as a fertilizer, replacing Chile saltpeter wherever employed for this purpose. It can, however, be used to replace the Chile salt as a starting point for the preparation of other compounds. The most important of these compounds are nitric acid, potassium nitrate, barium nitrate, ammonium nitrate, and sodium nitrite.

Sodium nitrite, as already seen, can be obtained most advantageously as one of the direct products from the gases of nitrate furnaces. The preparation of nitric acid from the lime salts has been noted in connection with the statements regarding its utilization.

MANUFACTURE OF POTASSIUM NITRATE.

The preparation of potassium nitrate, or ordinary saltpeter, from dilute nitric acid has been described. The manufacture from calcium nitrate by interaction with potassium chloride is easier to carry out than the customary conversion from Chile saltpeter, as the solubility of calcium chloride is so much greater than that of ordinary salt, NaCl , the by-product of the present method. The complete removal of the calcium chloride from the crystals of potassium nitrate by washing with cold water is effected with less loss of nitrate than otherwise is the case. On the other hand, it must be noted that the sodium chloride now obtained as a by-product has a distinct commercial value. In order to compete with Chile saltpeter as a source of potassium nitrate the calcium salt must have a market value distinctly less than that of an equivalent quantity of Chile saltpeter sufficient to offset the value of the sodium chloride obtained. Where the question of transportation charges does not assume importance the production of potassium nitrate directly from synthetic nitric acid will in all probability be found to be the most economical method available.

For some time to come, and probably as long as synthetic nitrate is produced in Norway alone, potassium nitrate will be manufactured chiefly from Chile saltpeter. About 45,000 tons of potassium chloride from Stassfurt are now used for conversion into saltpeter. Nearly one-half of the amount is consumed in Germany near the Stassfurt deposits. The German annual export of saltpeter exceeds 15,000 tons. The world's consumption of saltpeter is less than 70,000 tons per annum and does not tend to increase.

BARIUM NITRATE.

Barium nitrate, which has hitherto been obtained by the reaction between barium chloride and an excess of Chile saltpeter, is now manufactured from calcium nitrate and the mineral witherite, BaCO_3 . The solution of the nitrate is digested with the powdered mineral under a pressure of four atmospheres. Insoluble calcium carbonate and barium nitrate in solution are the result. As barium nitrate is not very soluble in cold water it is easy to purify it by recrystallization. There is an increasing use of this salt not only in

pyrotechnics and for high explosives, but also for the manufacture of barium peroxide, which serves in turn for the preparation of hydrogen peroxide. Germany exports annually 1,000 tons of barium nitrate and nearly as much barium peroxide.

AMMONIUM NITRATE.

The manufacture of ammonium nitrate grows rapidly in importance. At present the nitrate works at Notodden are devoted almost exclusively to its production. It forms likewise the sole product of the factory operating the Ostwald catalytic process for the oxidation of ammonia. A method for securing it from dilute nitric acid by electrolysis has been outlined above. Under existing conditions it is found most profitable at the Norwegian works to import ammonia water and make the salt by the direct combination of acid and base, as already described. Under other circumstances it may be found desirable to use calcium nitrate and an ammonium salt for the manufacture. R. Wedekind & Co. (German patent 231394) state that they have secured satisfactory results by the reaction in solution between crude calcium nitrate and ammonium sulphate. Ammonium nitrate is obtained in the form of crystals quite free from magnesium nitrate. The small amount of magnesium always present in technical calcium nitrate is precipitated in the form of the double salt, ammonium magnesium sulphate. It is necessary to use an excess of the calcium salt. (This is not lost, however, as the mother liquors are used to dissolve fresh amounts of nitrate.) They have been successful also with barium nitrate. The Norwegian company, on the contrary, finds the operation to be far from satisfactory. Better results are obtained with ammonium carbonate. As this salt is relatively much more expensive than the sulphate, they have adopted the ingenious expedient (French patent 408506) of dissolving calcium nitrate in ammonia water and passing a current of carbon dioxide through the solution, thus precipitating insoluble CaCO_3 . As already noted, carbon dioxide is given off in large amounts when calcium nitrate is made from limestone.

Any considerable demand for the production of pure sodium nitrate that may eventually arise in connection with the synthetic manufacture of nitrates can be met as economically by the direct use of soda solutions in the absorption system as by employing the calcium salt.

ANHYDROUS CALCIUM NITRATE.

In all cases where calcium nitrate needs to be transported for a long distance it might be well to consider the advisability of shipping it in the completely anhydrous form. When the solution of salt is evaporated to complete dryness the product contains 17.07 per cent of nitrogen, as compared with the 13 per cent of the current commercial compound. The latter contains 23.6 per cent of water, an amount that materially increases freight charges for long distances. In such cases the anhydrous salt could be shipped with advantage. On arrival at its destination, if required as a fertilizer, it could be transformed at slight expense, by the addition of water and lime, into the favorable combination for such purpose.

CALCIUM NITRATE AS A FERTILIZER.

Calcium nitrate is, chemically, an ideal compound for fertilizing purposes. The nitrogen present is assimilated by plant life with the same ease as that in the form of Chile saltpeter. There is, however, a very distinct advantage in employing a lime compound in the place of sodium nitrate. Sodium compounds are not needed by plants as food. If present in a soil beyond certain limits, they exert a distinct retarding action on plant growth. The continued use of Chile saltpeter causes naturally a gradual accumulation in the soil of such compounds, and their presence is evidenced by a growing tendency to harden and form crusts.

The invariable presence of chlorides and the frequent presence of perchlorate in Chile saltpeter are a marked drawback. Many crops, tobacco notably, and also grapes, are seriously affected by these compounds. As Chile saltpeter contains 2 to 3 per cent of sodium chloride, it has been replaced by guano in tobacco fields.

VALUE OF LIME COMPOUNDS.

In the majority of soils an addition of lime compounds is found desirable, as they contribute directly to an increase of crops, other conditions being equal. This is especially the case with sandy, granitic, or acid soils. The rôle played by lime salts in vegetable life seems to be essentially that of a carrier of nitrogen. When sodium nitrate is added to a soil it is in the form of calcium nitrate that the nitrogen is appropriated by growing plants. In view of the fact established by Lawes and Gilbert that plants eliminate a certain amount of toxic matter, and of the further observation by Whitney that lime acts as a disinfectant for these vegetable excreta, it is not impossible that calcium nitrate, especially in the basic form now commonly sold, may exert a particularly helpful action in this connection. While these chemical advantages are of recognized value, there is one physical disadvantage, and that is the marked hygroscopic property of calcium nitrate. This has been overcome in great measure, as already noted, by the use of a basic nitrate, but the use of the calcium salts still involves a greater measure of care and foresight than is required in the case of Chile saltpeter. The product must be shipped in tight, carefully closed barrels. When once opened the contents of a barrel must be used promptly before handling is rendered difficult by the absorption of atmospheric moisture.

APPLICATION OF THE FERTILIZER.

As calcium nitrate is much more hygroscopic than the sodium salt, there is need of increased precaution to avoid loss from the effect of heavy rainfall, with the consequent removal of dissolved nitrate from its intended field of activity either to the deeper subsoil or otherwise. French agriculturists advise the use of Norway saltpeter as much as possible in the form of top dressing. As a rule the application should be made twice at periods when there is an especial demand by plants for nitrogenous nourishment. Thus for winter cereals one-half of the total amount is spread over the fields the first

warm days of March. The remaining half is distributed in April or May when the heading out begins. In the case of root crops one-half is applied at the time of seeding and the remainder a few weeks later, care being taken to avoid letting the fertilizer fall upon the leaves.

The pronounced alkaline character of the Norway saltpeter limits to some extent the freedom with which it can be used as a top dressing. In Germany about two-thirds of the Chile saltpeter employed in agriculture is applied after crops are well advanced in growth.

When basic calcium nitrate enters the soil carbon dioxide is absorbed, the lime present is changed to calcium carbonate, and the normal nitrate is liberated. The carbonate gradually changes to the soluble form of bicarbonate and is available for plant food. A certain time is required for these changes. Keeping this fact in view, it is desirable to apply the nitrate to a field as near as possible to the period when it is needed for plant growth, in order to reduce to a minimum the risks of loss through excessive rainfall.

Continued experiment will undoubtedly reveal within a few years in just what manner the new nitrate can be most effectively and economically utilized as a fertilizer for individual crops with varying soils under different climatic conditions. At present it can be considered as fully equal in ordinary cases to Chile saltpeter in fertilizing power, comparison being based on equivalent amounts of nitrogen, while there is a pronounced advantage in applying it to sandy soils.

EXPERIMENTS WITH FERTILIZERS.

A number of comparative experiments have been conducted to establish the relative fertilizing value of nitrogen in the two forms. The first series was made with oats in 1905 at the Norwegian Agricultural Academy. On similar plats of a mixed soil of sand and clay (20 per cent clay) equal amounts of nitrogen in the form of the two nitrates were used. The resultant crops were as follows:

Fertilizer.	Grain.	Straw.	Fertilizer.	Grain.	Straw.
SANDY SOIL, FREE FROM CLAY.			SAND AND CLAY (20 PER CENT CLAY).		
	<i>Grams.</i>	<i>Grams.</i>		<i>Grams.</i>	<i>Grams.</i>
No fertilizer.....	3.6	15.1	No fertilizer.....	5.3	9.3
Norway saltpeter.....	24.1	43.2	Norway saltpeter.....	23.7	42.1
Chile saltpeter.....	21.7	42.9	Chile saltpeter.....	24.4	50.9
Chile and Norway saltpeter mixed.....	23.5	43.7			

In a series of experiments at the Royal Pomological Institute at Proskau in 1909, on a fairly rich soil that had been in continuous cultivation for a long time and contained an abundance of mineral plant food, the following results with potatoes were secured: With no fertilizer, 1,009 grams of tubers and 141 grams of starch; with Norway saltpeter, 1,729 grams of tubers and 261 grams of starch; with Chile saltpeter, 1,579 grams of tubers and 265 grams of starch.

The following table gives the results of French experiments in 1906, as reported by H. D. Feiltzen; the soil was of poor quality:

Fertiliser.	Grain.	Straw.	Fertiliser.	Tubers.	Starch.
OATS.	Grams.	Grams.	POTATOES.	Grams.	Grams.
No fertiliser.....	1,700	2,452	No fertiliser.....	687	103
Norway saltpeter.....	2,707	4,362	Norway saltpeter.....	2,629	493
Chile saltpeter.....	2,277	3,900	Chile saltpeter.....	2,323	414

In 1906 the agricultural station at Halle made comparative experiments with potatoes on normal soils on two estates, B and C; the results were as follows: With Norway saltpeter, 4,180 grams on B and 5,240 grams on C; with Chile saltpeter the yield was 3,770 grams for B and 3,940 grams for C.

Extensive experiments made by the Aberdeen and North Scotland College of Agriculture, 1905 to 1910, on soils deficient in lime, gave the following results with cereals: With no fertilizer, 2,196 pounds of grain and 27.7 hundredweight of straw; with Chile saltpeter, 2,595 pounds of grain and 35.2 hundredweight of straw; with Norway saltpeter, 2,816 pounds of grain and 38.5 hundredweight of straw.

C. Ampola in the reports of the Roman Agricultural Station, 1911, states that calcium nitrate gives uniformly a higher yield of both grain and straw than sodium nitrate.

French cultivators of the sugar beet who have experimented with the two nitrates for several years unite in reporting that the Norwegian saltpeter assures not only a greater weight of roots, but also a higher percentage of sugar in the juice.

CALCIUM NITRITE.

The formerly prevalent opinion that nitrites were injurious to vegetation is now no longer held; at least it has been fully demonstrated that plant life is detrimentally affected only when concentrated solutions are brought in contact with the roots.

The Italian chemists F. Perciabosco and V. Rosso have shown that the nitrites are assimilated by plant organisms without being first oxidized to the form of nitrates. They have further demonstrated that calcium nitrite possesses the same noticeable superiority over sodium nitrite as a fertilizer that calcium nitrate possesses over sodium nitrate. There is evidently no reason of a chemical nature against the introduction as a fertilizer of calcium nitrate containing nitrite; so far as transportation is concerned, there is an advantage in handling the mixture of nitrate and nitrite, as the percentage of nitrogen in the latter is materially higher than in the former. Anhydrous nitrite contains 21.2 per cent of nitrogen. The corresponding nitrate contains 17.1 per cent.

Here, however, as in the case of nitrate, trouble is occasioned by the hygroscopic properties of the salts. The "Badische" has lately found that mixtures of the two calcium salts, in which not more than 15 per cent of the entire amount of the nitrogen present is in

the form of nitrate, can readily be evaporated to dryness. The resultant product can easily be ground to a powder that deliquesces very slightly, even in moist air. With the removal of this mechanical difficulty there is good reason to expect the early introduction of the nitrate-nitrite mixture into the list of fertilizers. To what extent it may be necessary to transform limestone into quicklime in connection with the requisite modifications in the present method of manufacture later experiments must decide. The cost of fuel and the utilization to some material extent of the waste heat from an electric furnace are factors in this question. The best modern kilns now furnish quicklime with an expenditure of coal equal to less than 16 per cent of the weight of the lime produced. This would mean a consumption of 1 pound of coal for every 3 pounds of combined nitrogen secured by absorption of milk of lime, or an expenditure for fuel of less than 0.04 cent per pound of nitrogen.

SYNTHESIS OF HYDROCYANIC ACID AND THE CYANIDES FROM ATMOSPHERIC NITROGEN.

TECHNOLOGY OF THE CYANIDES

Until very recently cyanogen, C_2N_2 , and its immediate derivatives have occupied a comparatively subordinate position in chemical industry. Prussic acid, HCN , has long been known as one of the most powerful poisons, and the more complex salts, the ferricyanides and the ferrocyanides, have had a certain importance in color chemistry since the discovery of Prussian blue in 1704. The use of Prussian blue has been somewhat limited since the introduction of coal-tar colors, but there continues to be a steady demand for it and ultramarine as a pigment, especially in color printing and in the manufacture of wall paper. Ferrocyanides are now almost entirely supplied by gas works, forming one of the minor categories of by-products. In 1,000 volumes of illuminating gas there are one to three volumes of prussic acid. Although the amount is small, it is isolated in the form of ferrocyanide without great difficulty. European gas works easily supply the present commercial requirements, and there is no effort made to isolate the HCN present in the gas from coke ovens.

USE OF CYANIDES.

There was for some years a somewhat extended demand for potassium cyanide for use in "fixing" photographic negatives and prints, but it was supplanted by a cheaper and safer reagent, sodium thiosulphate (known erroneously as hyposulphite of soda or "hypo"). The introduction in 1887 by MacArthur and Forest (and almost simultaneously by Siemens and Halske) of the cyanide process for extracting gold from its ores led to a rapid increase in the call for alkaline cyanides. The world's consumption of alkaline cyanides was limited to less than 100 tons in 1880, that amount being used chiefly for galvanoplastic operations. In 1890 the demand increased to 750 tons; in 1900 to 8,500 tons. During 1911 Germany alone exported 6,520 tons of these salts, almost the entire amount going to gold-producing regions. The attention of chemists was promptly called to this field, and more economical methods of production were rapidly perfected. The price is now (Mar. 25, 1912) only 40 per cent of what it was in 1895. The chief factor was the discovery that aqueous solutions of the cyanides can be successfully evaporated, without decomposition, in the presence of a slight amount of free alkali, with the aid of vacuum apparatus. Several interesting syntheses have been perfected.

SYNTHESIS FROM AMMONIA AND SUGAR RESIDUES.

The first successful method involved the passage of ammonia gas over charcoal and caustic potash at a temperature of $900^{\circ}C$. A

still better process, resulting from the present low cost of metallic sodium, is based upon passing a current of ammonia over a mixture of this metal and charcoal. At 600°C . sodium cyanide, $\text{Na}_2\text{N}_2\text{C}$, is formed. At 800° this compound is changed, by reaction with excess of carbon, into sodium cyanide, NaCN .

Another process, lately perfected, effects a valuable utilization of the residues of beet-sugar manufacture. When evaporated to a thick sirup (specific gravity 1.4) they contain 4 per cent of nitrogen. If distilled, much of this nitrogen is liberated in the form of ammonia, of methylamine, $\text{NH}_2(\text{CH}_3)$, and trimethylamine, $\text{N}(\text{CH}_3)_3$. These two gases, on passing through cylinders maintained at $1,000^{\circ}\text{C}$., are decomposed and their nitrogen given off in the form of hydrocyanic acid, HCN . On leaving the apparatus the current of gases contains 10 per cent of HCN and 5 to 8 per cent of NH_3 . The latter is removed by using dilute sulphuric acid as an absorbent, and the former is secured as sodium cyanide by passage through a solution of caustic soda. Evaporation in a partial vacuum follows. Of the nitrogen present in the sugar residues, 35 per cent is rescued in the form of hydrocyanic acid and 25 per cent as ammonia; the remaining 40 per cent is lost.

Germany's annual beet-root crop exceeds 13,000,000 tons. If all the residues from the German sugar works were treated in this manner the annual production of sodium cyanide would represent the equivalent of over 10,000 tons of potassium cyanide. The operation is exceedingly profitable, as the raw material is practically valueless.

EVOLUTION OF SYNTHESIS FROM NITROGEN.

Studies have naturally been undertaken to effect the synthesis of cyanides from atmospheric nitrogen. A certain degree of success has attended these efforts, and as one direct result technical chemistry has been enriched by the creation of a new branch of industry—the manufacture of cyanamide—and an important advance has been made in establishing upon a firm basis an additional process for changing nitrogen from the elementary to the combined form.

As far back as 1813 Zincken noted the formation of saline masses in connection with the fusion of carbonaceous matter in metallurgical operations. That alkaline cyanides resulted from these fusions was established by Dawes in 1835. Contemporaneously with Zincken, Desfosses showed that at very high temperatures nitrogen reacted with mixtures of charcoal and the caustic alkalies, forming cyanides. Bunsen and Playfair showed that the reaction was capable of technical application. The fact was clearly established by them that when the bases, potash, soda, baryta, or lime, are mixed with carbon and heated in an atmosphere containing free nitrogen to a temperature at which the reducing action of the carbon becomes effective, a cyanide is invariably produced.

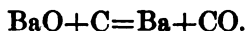
The form of carbon used—charcoal, coke, etc.—was found to have little influence. It was also a matter of indifference whether metallic carbonates or hydroxides were employed. The character of the metal involved was of pronounced importance. Better yields were secured with barium compounds than with those of potassium, and the latter were much superior to those of sodium. The presence

of such metals as iron, nickel, and manganese, all of which combine readily with carbon, seemed to aid the general reaction.

For half a century chemists were uncertain as to the exact nature of the reaction. There was much to indicate the formation from reduced metal of intermediary compounds, with cyanide as a secondary product. Some claimed the primary formation to be a nitride; others said it was a carbide. It was assumed that the nitride combined with free carbon to yield cyanide, and that the carbide yielded the same salt on combination with nitrogen.

In 1894 both Moissan and Wilson introduced processes for producing the carbides of barium and of calcium on a large scale with the aid of the electric furnace. This incited the German chemists A. Frank and N. Caro to investigate exhaustively the whole problem connected with the synthesis of cyanides from atmospheric nitrogen. In the course of a few years the chemistry of the reaction was fully explained.

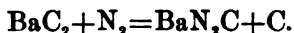
The sequence of changes may be illustrated by equations. Primarily, the base present is reduced with liberation of metal; in the case of baryta, thus:



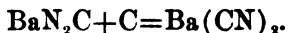
The free metal combines with the excess of carbon to form a carbide:



This carbide reacts with nitrogen to form barium cyanamide, with elimination of one-half of the combined carbon:



Under favoring conditions the cyanamide combines with the liberated carbon to form cyanide:



As an immediate result of the studies of Frank and Caro, it was found most advantageous to make the carbides of the alkaline earth metals the crude material for use in bringing nitrogen into combination. It was also soon found that while the cyanamides are well adapted to yield the corresponding cyanides, they constitute a class of compounds fitted to replace directly other nitrogenous substances as fertilizers in agriculture, and capable of transformation into a variety of forms of pronounced industrial value.

Calcium cyanamide was quickly recognized as the cheapest technical product in the class, and its production has been rapidly developed into a standard branch of chemical manufacture, which will be treated later.

CYANIDE REACTION IN MANUFACTURE OF AMMONIA.

The fact that cyanides are decomposed at a dull red heat by steam, all of the nitrogen present being changed into ammonia, was observed at an early date, and use was made of it with the first crude products containing synthetic cyanides. As far back as 1843 Newton, in England, patented a method in which crude potassium cyanide was obtained for this purpose by utilizing the gases issuing from sulphuric-acid chambers, which contain less than 7 per cent of oxygen. They were purified by passage through solutions of ferrous

sulphate and through milk of lime before being conducted into retorts containing charcoal and potash. This pioneer attempt was carried on for seven years, with yields corresponding to about 50 per cent of the theoretical. It was finally abandoned, as the plant rapidly deteriorated, and much potash was lost by volatilization; ammonia was produced more cheaply from gas works.

METHODS OF MARGUERITTE AND SORDEVAL.

The French scientists Margueritte and Sordeval perfected some years later (English patent 1027; 1860) a method that marked a very distinct advance. The marked affinity of barium for nitrogen had been observed, and baryta replaced potash. This was obtained in a very porous form, mixed with carbon and iron, by heating in a retort a mixture of barium carbonate, iron granules, asphalt, and wood shavings. Nitrogen was supplied in the form of a primitive generator gas, air being conducted over glowing coals, so that all oxygen was changed into carbon monoxide. The complete elimination of free oxygen from the operation was an important step forward. After the absorption of nitrogen was completed the reaction mass was cooled to 300° C. and exposed to the action of a current of steam. Ammonia was liberated, in company with carbon monoxide, according to the reaction:



The residual barium hydrate could be used repeatedly in the operation. The process was carried on several years, but finally abandoned as too costly.

OTHER PROCESSES.

L. G. and A. Brin (German patent 15298) revived the method in 1883, using a mixture of baryta, powdered charcoal, and coal tar for the original charge in the retorts. The air employed was freed from its oxygen in connection with the manufacture of barium peroxide, so that very nearly pure nitrogen entered the retorts. This process failed to achieve success.

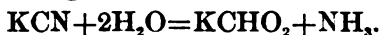
Contemporaneously the distinguished chemist L. Mond devoted much attention to the problem. His process (German patent 21175) is worked out in very minute detail. The plant constructed for the purpose consisted of a series of retorts arranged in a circle, as in a Hoffman brick kiln, so as to permit of the most economical use of the heat employed. A mixture of barium carbonate, charcoal, and pitch was pressed into the form of briquets and heated in a reducing flame. The briquets were crushed to small fragments before introduction into the retorts. Generator gas, and also the gas issuing from the absorption apparatus of the Solvay ammonia-soda process, were employed as sources of nitrogen, and a temperature of 1,400° C. was maintained during the reaction. After a fair trial Mond abandoned the method as a source of ammonia, finding that he could produce it much more economically by the action of steam on coal and coal waste.

Numerous variations of the fundamental ideas in the above three processes found expression in the form of patents.

T. B. Fogarty (1883) forced a current of highly heated generator gas through a tower against a descending shower of the mixture of charcoal and alkali in a powdered form.

De Lambilly and Chabrier (1889) mingled hydrocarbons with pure nitrogen, and claimed to secure a theoretical yield when acetylene was employed.

De Lambilly later (1892) mixed with his nitrogen coal gas that had been deprived of its hydrogen by passage over heated copper oxide. Granular iron or nickel was added to the mixture of carbon and alkali or baryta. The reaction product, after cooling, was exposed for a day or more to the action of a small amount of water. This was followed by heating in a retort, ammonia being liberated and a formate remaining, to be used anew:



C. H. Mehner, who has experimented in all the different fields for effecting the combination of nitrogen, patented in 1891 an electrical furnace for the purpose in view. The cyanides, as formed in the zone between the electrodes, distilled into a cooling chamber, where they came into contact with steam.

A recent process has been proposed in England by W. A. Philips and J. G. Bulteel (English patent 23046; 1910). They use a cylindrical furnace chamber, packed with magnesite or other refractory material and maintained at a high temperature. A mixture of air, hydrocarbons, and finely powdered barium carbonate is forced into the heated space through tangential openings. Barium cyanide is formed under these conditions and is carried along with the current of gases into a chamber where it encounters jets of steam. Decomposition into ammonia and barium carbonate ensues. The former is absorbed in the condensed water, and the latter is separated by filtration, dried, and used repeatedly. This use of hydrocarbons with barium carbonate will be encountered later in a method elaborated by the Badische Anilin- und Sodafabrik for the production of pure barium cyanide.

CYANIDES DIRECT FROM ATMOSPHERIC NITROGEN.

About 1843, while Newton was producing ammonia in England by the cyanide process, Possoz and Boissière established a plant for the manufacture of potassium cyanide at Paris. The plant included 24 retorts and was able to produce a ton of potassium ferrocyanide daily, but in 1847 the manufacture was abandoned as too costly. Numerous patented processes made their appearance in the following years.

In 1878 Weldon experimented with the manufacture in a revolving soda furnace. He demonstrated that the use of a temperature below a red heat was followed by an increase in the yield and a shortening of the time of the reaction.

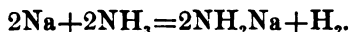
Swan and Kendall in 1895 claimed to secure good results by using nickel retorts inclosed in jackets of refractory material.

CASTNER'S METHOD.

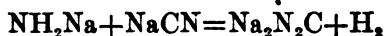
H. J. Castner (English patent 12218; 1894) introduced the use of metallic sodium at the beginning of its cheap production. The fused

metal trickled over charcoal maintained at a red heat in a vertical retort. A current of nitrogen mixed with hydrocarbons entered from above or from the sides. Melted sodium cyanide flowed from the lower end of the retort. It was found ultimately that better results could be obtained by substituting ammonia for nitrogen. The process ceased to be one for effecting the combination of free nitrogen and became one for transforming it from the relatively cheap form of ammonia into the much more valuable form of cyanide. It has been perfected in many ways by the Deutsche Gold- und Silberscheide Anstalt, of Frankfort. Thanks to the cheap electrolytic sodium, now costing less than 20 cents per pound, and to the Castner process, the price of cyanide has fallen to the present very low figure. Its essential details may be noted, as it stands in such close relation to the direct synthesis of cyanides from atmospheric nitrogen. It is also important in view of the fact that any prospective technical synthesis of ammonia can be combined most advantageously with this operation, which calls for a supply of the pure gas.

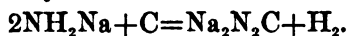
The process is based upon the reaction between sodium and ammonia, which gives rise to sodium amide and liberates hydrogen, as follows:



The reaction takes place easily at low temperatures, between 300° and 400° C. The resultant sodium amide is readily changed into sodium cyanamide by fusion with an equivalent amount of sodium cyanide:



or by heating with finely divided carbon:



By further fusion with carbon at 750° to 800° C. the complete change into cyanide is effected:



In the earlier years of the process ammonia was conducted over the surface of fused sodium or forced through it under pressure in an ingeniously devised retort of iron, until the change to amide was complete. This was then added to the equivalent amount of fused NaCN and transformed into cyanamide. As a variant, gaseous ammonia was forced through a fused mixture of sodium and sodium cyanide. Powdered charcoal was added to the cyanamide prepared by either method, and the transformation to cyanide effected slightly below 800° C. It was found that acetylene gas could be substituted for solid carbon with equally good results. It will be noted that a certain quantity of sodium cyanide was kept constantly in use to bring about the change from amide to cyanamide. One-half of the total amount of cyanide secured in an individual operation was employed in the treatment of the following charge.

During the past decade the operation has been notably simplified, but still requires most careful control of the temperature at the various stages. The process now in use at the works near Frankfort is conducted in large crucibles of iron. Each crucible receives a charge of 155 pounds of charcoal. Dry ammonia is slowly passed through it for a short time, the temperature being maintained at

500° C. The current of ammonia is then increased and 225 pounds of sodium are added. The temperature is gradually raised to 600° C. and kept at that point until the transformation to cyanamide is complete. It is then increased to 800° C., and the final change is rapidly accomplished. The fused mass is drawn off and filtered before solidification. Without further treatment it is a finished commercial product. The change of metallic sodium into cyanide is almost quantitative. The actual amount of sodium cyanide in the commercial salt ranges between 90 and 98 per cent. It is equivalent to 120-130 per cent of potassium cyanide, the customary standard for stating the value of cyanides.

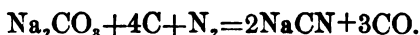
While Castner was developing his process there was a marked tendency on the part of other inventors to resort to the use of electricity.

METHODS OF READMAN, O'NEIL, AND MEHNER.

J. R. Readman (1894) patented a method that was practically the precursor of the present carbide and cyanamide processes. Use was made of an electric furnace lined with carbon. The charge consisted of five parts barium carbonate to one part coke or charcoal, intimately mixed. One electrode, at the bottom, was in the midst of the charge. The second electrode was attached to the top of the furnace and the arc extended from this to the charge. Nitrogen or generator gas was passed through the furnace. Fused barium cyanide was drawn off from the bottom of the furnace.

E. O'Neil (1902) proposed to pass a mixture of air with coal gas or petroleum vapor through the electric arc and effect the synthesis of hydrocyanic acid. He claimed at the time a production cost of potassium cyanide amounting to one-eighth of the current price.

A project of H. Mehner (1900) attracted much attention on account of several novel features. Capital was enlisted on a large scale, but no genuine technical success appears to have been attained. Soda ash was used as raw material, and it was sought to carry out the reaction as outlined originally by Bunsen and Playfair in the equation



RESULTS ATTAINED BY FRANK AND CARO.

The results of the experimental studies of Frank and Caro in revealing the real nature of the chemical reactions connected with the synthesis of the cyanides have already been outlined. It remains to note what was accomplished by them in developing actual technical methods.

At the outset of their investigations on the carbides they regarded the presence of moisture as favorable to the absorption of nitrogen, attributing to it a catalytic action. In the first experiments charges of 10 kilos of carbide absorbed 2 cubic meters of nitrogen in the course of two hours. The product, after cooling, was leached with water, and the cyanide formed passed into solution. In 1896 a plant was erected at Hamburg by the Dynamit Aktien-Gesellschaft, and the operation was carried on for some time. It was impossible, however, to secure satisfactory yields. It was recognized not only by Frank and Caro, but by others, notably by F. Rothe, that dry, pure nitrogen was all important for success.

In 1898, with the cooperation of Rothe, they ascertained that when barium carbide was heated in the presence of nitrogen only 30 per cent of the carbide was changed into the form of cyanide. The remainder was transformed into barium cyanamide with elimination of carbon. The size of the fragments of carbide was of some importance. Carbide, when crushed very fine, yielded an increased percentage of cyanamide; the reverse was the case when coarser lumps were employed. The favoring temperature for the absorption of nitrogen varied according to the carbide used. In the case of the barium compound it ranged from 700° to 800° C.; in the case of calcium carbide, from $1,100^{\circ}$ to $1,200^{\circ}$. It was also found that by fusing in soda or other alkaline salts the reaction product—containing cyanamide and free carbon—the two united to form cyanide, so that practically all of the nitrogen absorbed was finally available as cyanide. Various patents issued to the inventors at this period contained details regarding favoring temperatures and mixtures to attain the maximum yield of cyanide.

After preliminary experiments in the Hamburg establishment, which gave satisfactory results, a new company, the Cyanidgesellschaft, was formed to exploit the Frank and Caro patents. The controlling parties were Siemens and Halske, who have done so much to aid in solving the nitrogen problem, and the Deutsche Gold- und Silberscheide Anstalt, which is especially interested in cyanides. The necessary plant was erected in the works of the latter company at Frankfort, and the manufacture was established on a fairly extensive scale.

DEVELOPMENT OF THE CYANAMIDE METHOD.

Barium carbide was used as raw material. This was finely ground and exposed to the action of pure nitrogen at a red heat. The product, containing 30 per cent cyanide and 70 per cent cyanamide, was fused with soda and then leached with water. A residue of insoluble barium carbonate was available for renewed use in the carbide ovens. The solution contained sodium cyanide. By treatment with ferrous carbonate this was changed into sodium ferrocyanide. The latter salt is readily separated in a pure form. It was sold as such or used for the preparation of pure sodium cyanide by fusion with metallic sodium. As the operation was conducted at that time the barium carbide absorbed 90 per cent of the theoretical amount of nitrogen and yielded a product containing 11 per cent of nitrogen. Of the nitrogen thus combined, 86 per cent was finally secured in a commercial form.

A fall in the price of cyanides that accompanied the Boer War in South Africa forced the company to seek less expensive methods of preparation. Recourse was had to the cheaper calcium carbide, which was then being manufactured in increasing quantities. The lower molecular weight of the calcium compound was also a favorable factor. Experiments on a large scale showed that at the proper temperature it absorbed nitrogen quite as easily as barium carbide. This product consisted, however, almost entirely of calcium cyanamide. Still, upon fusion with alkaline salts, it was transformed into cyanide with as much ease as in the barium process. Several modifications in the sequence of operations followed the change to calcium carbide as raw material. Ordinary salt was used as a flux in

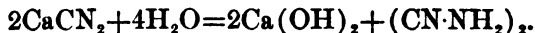
effecting the union of carbon and cyanamide to form cyanide. The resultant product was treated with a mineral acid and hydrocyanic acid was liberated and driven off, to be absorbed in solutions of the caustic alkalis. The solutions of potassium cyanide and sodium cyanide thus obtained were evaporated in vacuum stills and yielded salts of great purity.

In the calcium-carbide process it was found that about 90 per cent of the theoretical amount of nitrogen could be absorbed. The resultant calcium cyanamide contained 20 to 23.5 per cent of nitrogen. About 7 per cent of this nitrogen was lost on fusion with salt and transformation to cyanide. The subsequent operations, leading to the preparation of the cyanides in a commercial form, involve insignificant losses of nitrogen. Of considerable importance is the product directly obtained by fluxing with salt. This contains 30 per cent of sodium cyanide, the residue consisting of calcium chloride, lime, and carbon. Metallurgists state that it can be used directly without difficulty for the extraction of gold. There would appear to be a distinct field for this product. In order to limit the cost of freight or to avoid any difficulty from the deliquescent property of calcium chloride there might be an advantage in shipping calcium cyanamide directly to distant gold fields, where the fusion with salt could be effected.

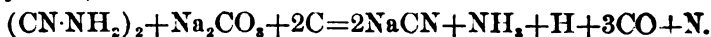
In 1901 the Deutsche Gold- und Silberscheide Anstalt surrendered its interests in the Cyanidgesellschaft in order to concentrate its efforts on the development of the Castner process for producing cyanides. The manufacture was transferred to Berlin. Material progress was made in the methods for supplying pure nitrogen and for increasing the percentage of its absorption by calcium carbide. In this period fall various patented variants of the process in which it was attempted to combine in a single operation the formation of carbide and its transformation into cyanamide by the direct action of nitrogen on a mixture of lime and coal. The division into two separate operations was found ultimately, however, to offer distinct economic advantages. The product of a single operation contained only 15 per cent of nitrogen and that of the double operation 22 per cent.

USE OF DICYANDIAMIDE.

An important advance in the manufacture of cyanides was achieved by the introduction of dicyandiamide $(\text{CN}\cdot\text{NH}_2)_2$. This is obtained from the crude calcium cyanamide by simple leaching with hot water—thus:



This substance is readily separated in a pure form by crystallization. The white crystals melt at 250°C . and closely resemble in appearance ordinary ammonium chloride. The compound contains 66.6 per cent of nitrogen. Apart from its value in connection with cyanide production, it promises to be of great use in several other branches of chemical industry. When dicyandiamide is fused with carbon and an alkaline carbonate a large amount is changed directly into cyanide, as follows:



Simultaneously a portion of the amide is volatilized mixed with the polymeric melamine (tricyantriamide). This sublimate is easily condensed and is utilized in a subsequent fusion. The ammonia liberated is completely absorbed by sulphuric acid and secured in a commercial form. There is, however, a loss of one-fourth of the nitrogen originally present, which escapes in the free form. Despite this loss the process offers the very decided advantage of furnishing directly, without further purification, potassium cyanide and sodium cyanide in a technically pure form.

STATUS OF SYNTHETIC-CYANIDE INDUSTRY.

Along with the development of this preparation of pure cyanides the manufacture of sodium cyanide by the fusion of cyanamide with salt was gradually improved until a commercial compound containing 95 per cent of NaCN became a staple article of production. This is ordinarily pressed into the form of briquets, which are heated for several hours in vacuum chambers at 70° C. The hard briquets are little affected by atmospheric conditions and are well fitted for transportation.

By the carbide method it is hence technically feasible to transform atmospheric nitrogen into three forms of cyanides, all of which find a market—pure cyanide, 95 per cent cyanide, and the so-called cyanide surrogate, which is 30 per cent pure, and is available for metallurgical operations.

As these various phases of the problem were gradually resolved, a new direction was given to the cyanamide industry. H. Freudenberg, another coworker of Frank, proposed the use of calcium cyanamide as a fertilizer. This was embodied by the two in a patent in 1901, and the energies of the Cyanidgesellschaft were gradually concentrated upon the effort to make the cyanamide process one of world-wide importance in bringing atmospheric nitrogen into a form available for the needs of agriculture. The production of sodium cyanide possessed for the time being a subsidiary interest. The annual output in the company's works reached 1,800 tons in 1909. It is now estimated at not over 2,000 tons.

BETTEL'S EXPERIMENTS.

A recent failure to effect successfully, under modern conditions, the synthesis of potassium cyanide, so frequently attempted during the second quarter of the past century, deserves mention here. W. Bettel describes (*Metall. and Chem. Engin.*, 1910, p. 81) a plant erected for the purpose. Charcoal was soaked in a saturated solution of potassium carbonate, dried, and introduced into retorts of the type used in gas works. A current of dry nitrogen was passed through the heated retort until absorption ceased. Under the most favorable conditions but 25 per cent of the potassium salt could be changed to the form of cyanide. The mixture of cyanide and carbonate was leached out, and a current of carbon dioxide passed through the solution. The hydrocyanic acid thus driven off was condensed in a current of falling spray. The resultant solution was concentrated by distillation and condensation, and then introduced into a solution of caustic potash until the latter was saturated.

Evaporation in a vacuum followed. The solution of potassium carbonate obtained by the treatment with carbon dioxide was used to soak fresh quantities of charcoal. After a fair trial the manufacture was abandoned as commercially unremunerative. The chief causes of failure were the excessive outlay for fuel and the continual loss of potassium carbonate due to the formation of sulphate, sulphide, etc., from sulphur in the charcoal. The consumption of the latter, through oxidation, formed also a material item. At the present state of our knowledge, it is not probable that any better result can be secured in attempting to carry on the reaction with alkaline carbonates and charcoal.

ACTIVITIES OF THE "BADISCHE."

The Badische Anilin- und Sodafabrik, which, as already noted, has played so important a part in furthering the solution of the nitrogen problem, took up the study of the cyanides in 1906. In that year it revived the Margueritte and Sourdeval process of 1862, in which use is made of a heated mixture of carbon and barium carbonate to effect the absorption of atmospheric nitrogen. It was found (German patents 190955 and 197394) that by saturating the mixture at about 1,500° C. with nitrogen, 60 per cent of the latter was in the form of barium cyanide, $\text{Ba}(\text{CN})_2$, and 40 per cent was in the form of cyanamide, BaN_2C . On lowering the temperature to at least 1,100° C. and passing a current of acetylene, C_2H_2 , through the apparatus while the temperature descended still further, all of the cyanamide was transformed into cyanide. This simplification of the process, involving but slight expense now that acetylene is furnished so cheaply from calcium carbide, offers new possibilities for the production of cyanides in this field. The necessity of separate fusion with an alkaline carbonate is obviated. Barium cyanide is easily dissolved from the reaction product. Upon the addition of an alkaline carbonate to the resultant solution insoluble barium carbonate is separated and can be used repeatedly in the furnace. The solution of potassium cyanide or sodium cyanide is evaporated in a vacuum apparatus, and yields a much purer product than is secured by the calcium-carbide process with the salt as a flux.

TITANIUM CYANIDE AND NITRIDE.

In 1907 the same company brought forward another interesting method of attaining the same end (German patent 200986). Advantage is taken of the remarkable affinity of titanium for nitrogen. The fact has long been known that when titanium oxide, TiO_2 , is heated with carbon in a current of nitrogen, a combination of titanium cyanide and nitride, $\text{Ti}_3\text{C}_2\text{N}_8$, is obtained. The tendency to form this compound renders the reduction of metallic titanium by the customary methods exceedingly difficult. It offers, however, a good opportunity for imprisoning a fair amount of atmospheric nitrogen. The compound in question represents the combination of 14 pounds of nitrogen by reaction with 100 pounds of titanium oxide. When it is fused with finely divided carbon and alkaline carbonates, a large share of the nitrogen present is transformed to the alkaline metal in the form of cyanide. In the production of sodium cyanide a mix-

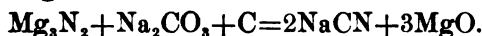
ture of 10 parts $Ti_{10}C_2N_8$ with 1 part soot and 16 parts Na_2CO_3 is employed. On leaching the cooled product gives a solution of the cyanide. The residue of TiO_2 can be used again for the absorption of nitrogen. If barium or calcium compounds replace the alkaline carbonates, mixtures of cyanide and cyanamide are obtained, as in the carbide methods. The cyanamide can be transformed into cyanide by fluxing or by treatment with acetylene as already described. As a source of ammonia this intermediary titanium compound offers even greater possibilities. On boiling with sulphuric acid all the nitrogen present is secured in the form of ammonium sulphate, and titanium oxide is left as a residue for renewed use in the furnace.

The "Badische" has likewise succeeded in preparing titanium nitride, TiN_2 , by heating in a current of nitrogen a mixture of TiO_2 with carbon and sodium sulphate (German patent 203750). This nitride, which had hitherto been secured by the reaction between the tetrachloride, $TiCl_4$, and ammonia, serves equally well for the production of cyanides and cyanamides. On account of its low melting point a mixture of the two alkaline carbonates in molecular proportions, $KNaCO_3$, is employed for the production of double cyanides, $KCN+NaCN$. With 12 parts of the carbonates to 3 parts of TiN_2 and 1 part of carbon fusion is maintained at a red heat for half an hour, when the reaction is complete.

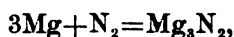
This nitride is even better adapted than $Ti_{10}C_2N_8$ for the transformation of nitrogen into the form of ammonia by treatment with sulphuric acid. Details of the process are contained in several patents of 1907 (German patents 202563, 203748, 204204, 204475, and 204847). In a still more recent patent (German patent 235662; 1909) the company extends the use of the reactions with titanium nitride for the production of cyanides to the allied nitrides of aluminum and of silicon, which are beginning to attract attention. The "Badische" is still engaged in perfecting various features of this group of interesting reactions, but as yet has established none of them on an industrial basis.

MAGNESIUM PROCESS.

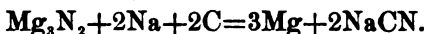
Magnesium is another metal with a very pronounced affinity for nitrogen, and its nitride, Mg_3N_2 , is prepared without difficulty by heating the metal in a current of gas. Schmidt, in 1905 (German patents 176080 and 180118), outlined methods for utilizing this property in the production of cyanides. By heating the nitride with carbon and sodium carbonate, sodium cyanide is produced, in company with magnesia:



The reaction when once fairly started proceeds without further need of external heat. It is also possible to bring about the same result by passing a current of nitrogen over a mixture of metallic magnesium, carbon, and sodium carbonate at a red heat. In order to recover the more expensive magnesium in the metallic form, the sodium carbonate is replaced by metallic sodium. Under these conditions the furnace reaction involves, first, the formation of magnesium nitride,



and, second, the formation of cyanide and the return of the magnesium to the metallic form,



The inventor claims a practically quantitative yield.

BARIUM PROCESS.

Closely allied to the above is an American process lately patented by The Nitrogen Co. (French patent 425025; 1910), in which barium serves to convey nitrogen to the alkaline metal. Use is made of a vessel divided into two compartments, with communication at the bottom by means of a bath of molten lead. In one cell a fused mixture of barium chloride and sodium chloride undergoes electrolysis as fast as formed. The metallic barium and sodium are alloyed with the lead. In the second cell, which is kept at the favorable temperature, an atmosphere of nitrogen is maintained. Charcoal is introduced and kept in constant agitation with the fused alloy. As a result sodium cyanide is steadily formed. From time to time the agitation is interrupted, the temperature is lowered, and the layer of cyanide, floating on the alloy, is withdrawn. The operation is, however, practically continuous. Salt is added to the electrolytic cell, while in the reaction cell proper nitrogen and carbon are introduced and sodium cyanide withdrawn. The nitrogen current can be replaced by one of ammonia, but special provision must be made to conduct off the liberated hydrogen. The inventors assume that barium carbide is first formed. The formation of an intermediary barium nitride, as in Schmidt's magnesium process, is, however, likewise probable. In both methods a constant supply of a metal possessing a marked affinity for nitrogen is the pronounced feature. It would appear more economical to employ in the process of The Nitrogen Co. metallic sodium already prepared more cheaply by the electrolysis of caustic soda.

There is a certain simplicity in the reactions based upon the use of magnesium and barium, as outlined above, that augurs much for a possible development in the early future into effective technical operations.

METHODS OF SECURING PURE CYANIDES.

In many of the methods used to secure cyanides from atmospheric nitrogen they are primarily obtained in the form of a mixture with other salts, such as the alkaline carbonates or chlorides, calcium chloride, etc. It is important to note the reactions lately perfected to isolate technically pure cyanides from such mixtures without material loss. They are applicable also to the impure products obtained from the by-products of gas works and sugar refineries, and to those secured by synthesis from ammonia. This is now effected with ease by J. Tcherniac, of London, a well-known authority on cyanides (German patents 182774 and 207886). In the case of concentrated solutions where chlorides are abundant it is found possible to effect the crystallization of potassium cyanide and sodium cyanide by the addition of caustic alkalies in the solid form. The free alkali of the mother liquors is afterwards changed into cyanide by a current of HCN. When the impurities are chiefly carbonates and sulphates,

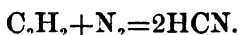
as well as free alkali, lime or baryta is added. The solution obtained by filtration from the precipitate of carbonate and sulphate is then neutralized with HCN. The solution of fairly pure cyanide is finally crystallized by evaporation in a vacuum.

In older methods, depending upon the treatment of mixtures containing cyanides with stronger acids, as practiced by Frank and Caro at the outset, hydrocyanic acid being liberated and then absorbed in an alkali, there is more or less loss on account of the incomplete decomposition of the cyanide. W. Feld (German patent 217272) prevents this loss by passing over the cyanide mixture during the distillation a current of superheated steam. Good results are also obtained by using, instead of steam, a current of carbon dioxide, furnace gas, or simply heated air.

SYNTHESIS OF HYDROCYANIC ACID.

EVOLUTION OF THE PROCESS.

While there has been such a variety of attempts to effect the synthesis of the cyanides from elementary nitrogen, similar efforts to produce hydrocyanic acid itself have been exceedingly limited, possibly on account of the intensely poisonous properties of the compound. As far back as 1869 Berthelot showed that nitrogen could combine directly with acetylene under the influence of silent electric discharges:



The reaction was neglected until 1902, when Hoyermann repeated it, using the heat of a modern electric furnace and conducting the gases through hollow carbon electrodes into the arc. Favorable proportions were 1 volume of the hydrocarbon to 12 volumes of nitrogen. His yield at the time reached 70 per cent of the theoretical, based on the amount of acetylene employed, and he regarded the reaction as one capable of technical realization. A contrary opinion was expressed a year later by Gruszkiewicz. His experiments tended to show that the reaction could be carried on only in the presence of an excess of nitrogen and of a much greater volume of hydrogen. If acetylene formed more than 5 per cent of such a mixture, it underwent decomposition. Further experiments made by him indicated the availability of water gas and Dowson gas as better fitted to yield HCN with the aid of the electric arc. Even with these the yield was low. The best results were secured with a mixture containing 52 per cent of CO, 31 per cent of N, and 17 per cent of H. This yielded but 0.4 per cent of HCN on passing through the arc, but gave promise of technical utilization. During the past three years renewed attention has been given by several chemists to the possibilities of the hydrocyanic-acid synthesis.

DIEFFENBACH AND MOLDENHAUER PATENTS.

O. Dieffenbach and W. Moldenhauer, in connection with the Chemischefabrik Griesheim Elektron, have devised a method for carrying out the reaction that is regarded in Germany as one of great promise (German patents 228539 and 229057). As in the case of the synthesis of nitric oxide from atmospheric nitrogen, success

depends largely upon the form of apparatus and the manner of bringing carbon, hydrogen, and nitrogen simultaneously and briefly into the electric arc. The inventors made use of a cylindrical iron furnace lined with refractory material. The bottom of the furnace consists of a large block of carbon, which forms one electrode. The other electrode, likewise of carbon, enters through the top of the furnace and is hollow. It extends nearly to the center of the furnace, and is inclosed by a shield of refractory material, so that an annular space exists between the two.

The gases required in the reaction are introduced at the base of the furnace. The gaseous products make their exit through the upper hollow electrode. Through another opening in the top of the furnace provision is made for the continuous entrance of fragments of coke. The arrangement is such, in consequence of the position of the shield, that the terminal of the upper electrode is in the center of a small, free space, the shape of an irregular inverted cone, inclosed by the mass of coke fragments. When a direct current is used the mass of coke becomes itself an enlarged electrode—the anode. The confined space about the terminal of the upper electrode is then a diminutive reaction chamber with a maximum of heat. As the arc plays between the upper terminal, the cathode and the coke fragments, carbon is continually volatilized and is in a condition favorable for combination. The consumption of electrode carbon is thereby prevented. Nitrogen and hydrogen, passing upward through the hot coke, enter this highly heated space, come in contact for an instant with volatilized carbon, and combination takes place. The gas current is rapidly conducted away and cooled, so as to prevent the disintegration of HCN into its constituents, which follows removal from the source of heat, before a temperature assuring stability of composition is reached. The HCN thus formed is removed by absorption in an alkaline solution, and the residual current of hydrogen and nitrogen returns to the furnace. It is found to be of advantage to increase the supply of carbon for the reaction by introducing it in a finely divided form into the current of gases as they enter the reaction space. Hydrogen can likewise be replaced by hydrocarbons. The latter undergo decomposition at the high temperature, and the nascent carbon, for an instant in the form of vapor, readily enters into chemical union. It is of importance, however, that the proportions of hydrogen and nitrogen be always in excess of those required to change the carbon present into HCN.

ESSENTIAL FEATURES—PROPOSED MANUFACTURE OF NITRIC ACID.

The essential features here are a furnace arrangement only slightly exposed to wear, the use of nitrogen free from oxygen, and the employment of hydrogen to a greater or less extent in the form of cheap hydrocarbons. Comparison will naturally be made with the synthesis of ammonia. The cost of the carbon required in the reaction is small. Only one-third as much hydrogen is needed, and that may be supplied in the form of cheap hydrocarbons. The plant and the operation itself are much less costly than in the case of Haber's synthesis. The expenditure for heat or electrical energy would probably be proportionately greater.

There is much to indicate that this new line of attack may develop into an important factor in solving the nitrogen problem. When comparison is made with the electrical method of accomplishing the synthesis of nitric acid from the atmosphere, no necessity would probably be encountered for such a costly and extensive absorption plant. The future of the process will depend almost entirely upon the ratio between the expenditure of electrical energy and the yield of nitrogen in a combined form. If that can be established upon an equal or lower cost basis than is involved in any of the competing methods, a most interesting contribution will be made to the solution of the general problem. Apart from meeting the somewhat limited needs of the cyanide industry, the ease with which hydrocyanic acid and its salts can surrender their nitrogen in the form of ammonia enables them to meet readily the wants of agriculture.

Dieffenbach and Moldenhauer propose to use the hydrocyanic acid generated by their process not only for the manufacture of cyanides but also for the production of nitric acid. When HCN is burned in the air under ordinary conditions the products are free nitrogen, water, and carbon monoxide. Experiment has shown, however, that by conducting a mixture of air and hydrocyanic acid over such catalytic agents as palladium, platinum, iridium, and manganese dioxide nearly all of the nitrogen present in the acid in the combined form is oxidized to nitric oxide, NO. The transformation of the latter to nitric acid is brought about as in the Norwegian works, but with greater ease, as the percentage in the gaseous current is relatively much higher. The technical feasibility of this reaction is awaited with great interest, as it may have an important bearing on the whole nitrogen question.

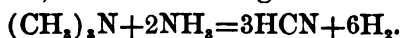
HYDROCARBON PROCESS.

In France the Société Anonyme pour l'Industrie de l'Alun (French patent 417794) outlines likewise a process for securing HCN by exposing a mixture of nitrogen, hydrogen, and hydrocarbons to a high temperature. There is a similar system of absorbing the acid formed by the reaction and returning the residual gas to the furnace. Provision is made for avoiding too great an excess of hydrogen in the gas circuit as the result of the decomposition of hydrocarbons.

SYNTHESIS FROM METHANE-AMMONIA PROCESS.

A. V. Lipinsky (*Zeitschrift für Elektrochemie*, 1911, p. 761) finds that on passing electric discharges through a mixture of nitrogen, hydrogen, and methane, CH₄, the last named can be changed completely into HCN. A favorable mixture is 10 per cent of hydrogen, 20 per cent of methane, and 70 per cent of nitrogen. The yield of HCN is equivalent to 19 per cent of the mixture. The large excess of nitrogen is necessary in order to prevent separation of free carbon. Evidently ordinary coal gas can form a basis for preparing such a mixture.

Of incidental interest in this connection is the recently patented process of O. Liebknecht, of Frankfort, for manufacturing HCN by passing ammonia gas and trimethylamine (from beet-sugar residues) through red-hot tubes, the reaction being as follows:



HAUFF'S PATENTS.

Of greater importance for the future utilization of synthetic hydrocyanic acid is the method lately patented by F. Hauff (German patent 232878) for effecting its change to ammonia. On passing gases containing varying amounts of HCN in company with steam through tubes kept at a temperature of $1,200^{\circ}$ C., over 90 per cent of the acid is changed to ammonia. It is important to prevent the presence of even traces of oxygen in the mixture.

The same inventor, in company with R. Schall and others (German patent 220354), has also shown that perfectly dry nitrogen combines with carbon at a high temperature, preferably that of the electric arc, to form cyanogen, C_2N_2 . Carbon in the form of charcoal or soot, not graphitic, is necessary for the reaction. As cyanogen forms a starting point for the synthesis of the more complex derivatives, there is a possible variant here on the method now being elaborated at the Griesheim Elektron works.

ATMOSPHERIC NITROGEN IN THE FORM OF NITRIDES.

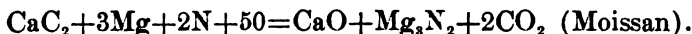
Reference has been made to the readiness with which nitrogen combines with various metals, notably with titanium, magnesium, etc. Of recent years much has been done to test the availability of this class of compounds for imprisoning free nitrogen and furnishing it in a combined form for employment in chemical industry. As yet none of them possess distinct use in the arts. They all readily surrender their nitrogen, however, in the form of ammonia. It has been hoped that some nitrides might prove to be susceptible of direct use as fertilizers, but thus far there is no direct indication of the realization of this hope. At present aluminum nitride is most interesting as promising to effect a very economical transformation of atmospheric nitrogen, on an industrial scale, into ammonia. The availability for technical use of certain metals and nonmetals possessing a marked affinity for nitrogen may be passed in brief review.

LITHIUM.

The metal lithium is unexcelled in the ease and rapidity with which it combines with nitrogen. The compound Li_3N is even formed when the metal is exposed to the action of moist air. When heat is used a violent reaction ensues. Should the metal ever become cheap and abundant it will present the simplest medium for bringing nitrogen into combination. Nitrides of the allied metals, potassium and sodium, are of doubtful existence.

MAGNESIUM.

Next to lithium, magnesium possesses the most marked affinity for nitrogen. When the metal is heated in a current of nitrogen, absorption of the gas and formation of Mg_3N_2 proceed rapidly. This nitride is also formed by absorption of atmospheric nitrogen when magnesium and calcium carbide are heated together in the air at a dull red heat:

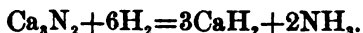


The affinity is so pronounced that many cyanides and nitrides surrender their nitrogen to magnesium when heated with the metal. The nitride can be secured without first preparing the metal, when nitrogen is passed over a mixture of carbon and magnesia in an electric furnace. Willson attempted in 1895 to make this the basis of a technical production of ammonia. A year later Mehner (German patent 88999) extended the operation to a variety of oxides, including also TiO_2 , SiO_2 , etc. Mehner contemplated a general use

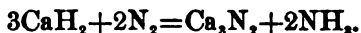
of the nitrides thus obtained as fertilizers. While much was expected in the early days of the electric furnace from the utilization of magnesium nitride, the discovery by Frank and Caro of the ease with which calcium carbide could absorb nitrogen prevented for the time being the technical elaboration of the reaction. As already noted, there is a recent prospect of the nitride assuming importance in connection with the production of cyanides. Magnesium is now manufactured regularly in Germany by the electrolytic process, and with increasing cheapness. Its marked affinity for nitrogen may yet come to play a more pronounced rôle.

BARIUM AND CALCIUM.

Both metals unite directly with nitrogen to form nitrides, although less easily than in the case of magnesium. These nitrides offer an interesting reaction, which can also be effected with the nitrides of magnesium, manganese, and some other metals. When heated in a current of hydrogen the nitrogen is given off in the form of ammonia and a hydride of the metal is formed, thus:



K. Kaiser (French patent 350966) makes this the basis for a technical process to produce ammonia, proposing to pass a mixture of nitrogen and hydrogen over the nitride at the favorable temperature. The nitride should act in this case essentially as a catalytic agent, changing back and forth from hydride to nitride.



The method was submitted to a critical examination by Prof. Haber. It was found that in the case of calcium nitride the reaction could be carried on at 800°C ., but that the amounts of ammonia secured were too small to render the process economically feasible. Manganese nitride can be used at a lower temperature, 550° . The yield is better, but still too slight for the needs of a practical process. As already noted, Prof. Haber found later in osmium and in uranium admirable catalytic agents for effecting the synthesis of ammonia.

MANGANESE AND IRON.

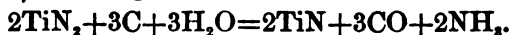
Manganese possesses two nitrides, Mn_3N_2 and Mn_5N_2 . They are most easily prepared by distilling manganese amalgam (obtained by electrolysis) in a current of nitrogen, and are less easily decomposed by water than is calcium nitride. Ferric nitride, Fe_3N_2 , is formed with difficulty when the metal is heated in nitrogen, or the electric arc passes between iron electrodes in an atmosphere of nitrogen. Better results are obtained when the iron is in the nascent state, as when the oxide is reduced by coal or by nitrogen in an atmosphere of nitrogen. Ordinarily it is made by heating ferrous chloride in an atmosphere of ammonia. The white brittle substance is but slowly decomposed by boiling water, with evolution of ammonia. Acids decompose it easily. Altogether it seems poorly adapted to render much service in connection with atmospheric nitrogen. Were it endowed with the affinity for nitrogen of lithium, for example, the whole problem of imprisoning atmospheric nitrogen would be promptly settled.

BORON.

The affinity of boron for nitrogen is very pronounced, and the nitride, BN, shows much resistance to the attacks of water, alkalies, or acids. When heated to 200° C. with water or caustic alkalies the nitrogen is given off in the form of ammonia. Various attempts have been made to utilize this strong affinity for nitrogen, but thus far without practical results.

TITANIUM.

The affinity of nitrogen for titanium has been noted in connection with the use of this metal for producing cyanides. Years ago Tessié du Motay proposed the use of titanium nitride as a source of ammonia. The normal nitride, TiN_2 , on heating in a current of hydrogen, yields nearly one-half of its nitrogen in the form of ammonia. The residual lower nitride, TiN , on heating in an atmosphere of nitrogen, absorbs an additional amount of the latter, and reverts to the form TiN_2 . Repeated attempts were made in France and in England to build up an industrial process for the manufacture of ammonia on the basis of this reaction, but without success. The possibilities of this nitride have been recently tested by H. B. Landmark (Norwegian patent 20198). He claims to have perfected a continuous process for the manufacture of ammonia from this nitride, based upon the following reaction:



Steam is passed over the heated mixture of nitride and carbon. By substituting a current of nitrogen for steam, the normal nitride is regenerated; and by using a current of steam and nitrogen, the operation becomes continuous, requiring from time to time the renewal of the supply of carbon. Essentially the titanium compound acts here as a catalytic agent, and it remains to see whether the reaction proceeds with sufficient rapidity to make it technically feasible. If it does it may be that the titanium compounds will play a prominent rôle in solving the nitrogen problem.

The question is of special interest in the United States, where ilmenite ($FeO \cdot TiO_2$) is so abundant, and where the technical production of pure titanium oxides was successfully accomplished by Fitzgerald and Bennie in 1909 (American patent 921686). In this process crushed ilmenite is concentrated by magnetic treatment and then reduced by the aid of coal in an electric furnace. The metallic iron that is formed is removed from the mixture of TiO_2 and Ti_2O_3 by the use of the magnet and with the help of dilute sulphuric acid. This means a relatively cheap and unlimited supply of the requisite oxide. The metallurgy of titanium has likewise rapidly assumed importance in Germany, where ferrotitanium (25 per cent Ti) and manganotitanium (35 per cent Ti) are now regularly manufactured at Essen.

SILICON.

This element, like carbon, possesses a strong affinity for nitrogen, and combines directly with it at a white heat to form the nitride Si_3N_4 . In the presence of carbon, a carbonitride, Si_2C_2N , is obtained. The nitride is infusible and remarkably resistant to the

action of oxygen, acids, and alkaline solutions. On fusion with caustic alkalies it yields ammonia and a silicate. Fused with alkaline carbonates it gives a silicate and a cyanate.

As silicon forms a quarter of the earth's crust, its affinity for nitrogen could assume considerable importance should any method be devised for effecting an economical reaction with silica, SiO_2 , its ordinary form of combination.

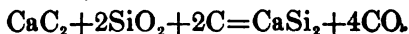
METHODS OF UTILIZING SILICON COMPOUNDS.

In 1895 Mehner proposed (German patent 87498) the use of silicon nitride in agriculture, its high percentage of nitrogen rendering it peculiarly susceptible to transportation. Ten years later Roth-Cauth outlined a process for its preparation (German patent 197393), which did not advance beyond the experimental stage.

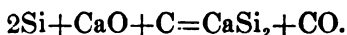
In 1909 Weiss and Engelhardt experimented upon the action of pure nitrogen on silicon in an electric furnace and found that there was no combination below $1,420^\circ \text{C}$. Above that temperature the reaction is comparatively slow. In addition to the normal nitride, Si_2N_3 , lower nitrides are also formed, all equally stable and resistant.

The future possibilities of utilizing silicon nitride seem, however, to depend upon the primary use of compounds of silicon rather than silicon itself, although the latter, with only 10 per cent of foreign matter, is now manufactured by the Carborundum Co., at Niagara Falls, and costs \$120 per ton. The silicides offer a field of some promise, corresponding in many respects to the carbides.

In 1910 A. Kolb (German patent 222237) found that nitrogen combines readily with calcium silicide at $1,000^\circ \text{C}$. and gives off ammonia easily through the action of steam. The reaction here is very similar to that occurring with calcium carbide. The chances would appear to be against its offering any economical advantage over the absorption of nitrogen by the carbide, as the latter is employed to produce the silicide in some current methods. La Compagnie Générale d'Électrochimie de Bozel, at Paris (German patent 206785), uses for the purpose calcium carbide, silica, and coal:



It also employs silicon and lime:



Goldschmidt, in Essen (German patent 215609, and patent appl. N. 38268), uses for the reaction mixtures of lime and silicon in an electric furnace. Merck, of Darmstadt (German patent 215609), heats mixtures of silicon and the oxides and peroxides of barium and of calcium.

The Magnesite Co., of Hamburg (German patent 234129), claims to secure mixtures of silicon nitride and metallic nitrides without difficulty in the electric furnace when nitrogen is passed over carbon and silica, to which metals, their oxides or their salts, have been added.

Much interest has been awakened by the Scandinavian chemists, A. Sinding-Larsen and O. J. Storm, of Christiania, who claim to have perfected the electric production of silicon nitride (German

patents 229638 and 231090). In their earlier methods nitrogen is allowed to act upon silicon in the form of a silicide, i. e., when dissolved in iron or aluminum.

PREPARATION OF ALUMINUM SILICIDE.

Aluminum silicide is prepared for this purpose by the reduction of aluminum silicate. After the treatment with nitrogen the metallic aluminum present is driven off by distillation, and the residue consists of silicon nitride. The nitride thus obtained is in a very finely divided form, and the inventors state that it is susceptible of direct employment as a fertilizer. In a later modification silicon is liberated in an atmosphere of nitrogen, and the reaction goes on rapidly when it is in the nascent state. It is also distilled and partly condensed, in a very fine powder, in nitrogen. Under such circumstances the yield is said to be quantitative. The presence of a reducing gas, preferably a hydrocarbon, is found to favor the reaction. The reaction is extended to a variety of minerals, such as feldspar, kaolin, and various other silicates as well as phosphates and even carbonates. By the combined action of reducing gases and nitrogen in an electric furnace it is possible to secure nitrides of silicon and the metals present, as well as cyanides, cyanamides, etc. The temperature, the proportions of gas used, the rapidity of the gas current, and other varying conditions control the exact nature of the products.

THE "BADISCHE" PATENTS.

The use of silicon compounds seems promising also to the Badische Anilin- und Sodafabrik, which lately protected its methods by several patents (German patents 200986, 234129, 235300, 235662, 235765, 235766, 236342, 236395, 236892, and 241510). In the simplest form of the reaction silica is heated in a current of nitrogen, with coal and a small amount of an alkaline flux (for example, 75 parts silica, 25 parts coal, 2 parts soda). The temperature is kept at 1,300° to 1,400° C. for 10 to 12 hours. After cooling in a current of nitrogen the product is boiled with a 20 per cent solution of caustic soda, and all the nitrogen absorbed is recovered in the form of ammonia. Lime can replace soda, but in that case the reaction must be carried on for several hours under constant agitation, in autoclaves, at 160° C. The amount of caustic soda required to liberate a given amount of ammonia can, however, be very materially lowered by the addition of various salts, especially ordinary sodium chloride. Thus 100 kilos of crude nitride of silicon and aluminum yield all of the nitrogen present as ammonia when boiled with 400 liters of water in which 2 kilos of caustic soda and 40 kilos of salt have been dissolved. Good results have also been secured by the action of steam on mixtures of crude nitride and caustic soda in the solid form. Thus, a nitride containing 32 per cent of nitrogen, prepared from infusorial earth and peat charcoal, is finely ground and mixed with 1.4 times its weight of caustic soda. The charge is introduced into an iron cylinder maintained at 400° C. Steam is passed over it at this temperature, and the change of the combined nitrogen to ammonia is almost quantitative.

Silicates may be used instead of silica, and the addition of various metals or their salts or oxides enables the reaction to proceed more rapidly and at a lower temperature. These crude nitrides can be changed into cyanides and cyanamides when heated or fluxed with salts or oxides of the alkalis and alkaline earths. It is possible also to use them as a basis for the manufacture of alums. Thus, ordinary refractory clay, when reduced with coal in an atmosphere of nitrogen, gives a product containing 26 per cent of alum. About one-third of the nitrogen is combined with aluminum, and the remainder with silicon. This product, when treated with sulphuric acid, furnishes a solution of ammonia alum.

The "Badische" claims that the process has been so perfected that it is capable of introduction as a cheap, competitive method of producing ammonia. As yet no plant has been constructed on a large scale.

ALUMINUM.

SERPEK'S PROCESS.

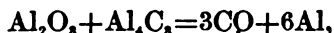
Dr. O. Serpek has elaborated a method for producing aluminum nitride that offers much promise of developing into a technical process of some magnitude. The work in this field began in 1905 and was carried on at Niedermorschweiler, near Dornbach, in Alsace. M. Badin, the manager of A. R. Pechiney & Cie., of Salindres, France, has been of material aid in furthering the development of Serpek's method, and much experimental work has likewise been done at Salindres. The process is now in the hands of a company organized at Paris for the purpose, and a plant on a large scale is being erected in the Department of Savoy. The following patents cover the essential features of Dr. Serpek's process up to the present time: German patents 181991, 183702, 216746, 224628, 231886, 235213, 236044, 236669, 238340, 239909, 240403, and 241339.

At the outset he used aluminum carbide, in a powdered form, as raw material. This was mixed with coal and exposed to the action of a current of nitrogen at an elevated temperature. Later the formation of the carbide from alumina and coal and the reaction with nitrogen were combined, and it was found advantageous to add iron or copper, as well as lime, to the charge of alumina and coal. Proportions were so chosen that the nitrogen acted practically upon a mixture of metallic aluminum, aluminum carbide, and alumina. Experiment had shown that aluminum carbide alone was able to absorb an amount of nitrogen equivalent to 6 per cent of its weight. If 1 per cent of metallic aluminum was added to the carbide, the quantity of nitrogen absorbed increased to 15 per cent. An electric induction furnace was found to yield the best service.

In such a furnace he devised later a continuous production of nitride. At one end of the furnace molten carbide of iron was introduced, while an atmosphere of nitrogen or of generator gas was maintained. A mixture of coal and alumina was added to the molten mass, and aluminum nitride was withdrawn at the other end of the furnace.

ADVANTAGES OF LOW TEMPERATURE.

The opinion held at first by Serpek—that the nitride could be formed only by reaction between metallic aluminum and nitrogen—led to the use of very high temperatures in the earlier stages, such as were necessary for the reduction of the metal from its oxide. Gradually it became evident that the best yields of nitride were secured at temperatures below 2,000° C.—temperatures at which there is no formation of aluminum or of aluminum carbide in atmospheres free from nitrogen. The process assumed thus a simpler form and consisted essentially of heating a mixture of alumina and coal in a current of nitrogen at temperatures below 2,000° C., preferably at 1,800° C. In some cases a higher temperature was employed until about one-fifth of the charge was changed to carbide. The current of nitrogen was then introduced after a certain degree of cooling, and combination with nitrogen, accompanied by a notable evolution of heat, took place. This evolution of heat is so strong that in an electric furnace the current can be shut off completely when the reaction begins. Serpek assumed that under the prevailing conditions alumina and aluminum carbide reacted, with liberation of metallic aluminum, thus:



and that the nascent aluminum combined easily with nitrogen. There is much to bear out this theory. The reaction between alumina and carbon proceeds very slowly in the absence of nitrogen, while it becomes exceedingly active when a current of nitrogen is introduced.

REVOLVING ELECTRIC RESISTANCE FURNACE.

A most effective contrivance for carrying out the operation has been devised in a revolving electric resistance furnace. This is connected directly with the generator supplying the gas employed in the reaction, so that all of the heat derived from the generator is thoroughly utilized and the consumption of electricity is reduced to a minimum. In the ordinary arc furnace, or in a resistance furnace in which the charge itself furnishes the resistance, it has been found impossible to secure a uniform distribution of the heat. Some portions of the charge are overheated, and in consequence carbide is formed in excess. Other portions are inadequately heated. These difficulties seem to be overcome in the revolving furnace. The resistance proper is furnished by spiral bars composed of compressed carbon and aluminum nitride in the proportions of 1 to 2. These are embedded in the lining of the furnace, which is also of nitride.

At the ends of the cylindrical furnace these bars are inserted into disks of carbon, which form the terminals of the electric current. As the revolving furnace is slightly inclined, its charge is heated very uniformly by contact with the resistance bars. Powdered bauxite is used for the reaction. It enters first a revolving calcination tube, in which it is exposed to the hot gases issuing from the generator and the electric furnace. After calcination it passes into

an intermediary chamber where mixture with coal is effected. In this chamber a certain amount of air is injected in order to burn the silicon volatilized from the furnace proper. The resultant SiO_2 is removed by baffle plates from the current of hot gases before they enter the calcination cylinder. From this intermediary chamber the charge is directed into the furnace, from which it issues in the form of crude nitride. The pressure in the furnace is kept slightly above that of the atmosphere. Its lining consists of compressed nitride. Recently it has been found that the operation can be accelerated and the yield increased if sulphur or sulphur compounds are added to the charge.

PROPOSED IMPROVEMENTS.

In the latest patents Dr. Serpek proposes to combine the nitride process with Bayer's method of preparing pure alumina. In the latter operation bauxite is exposed to the attack of a concentrated solution of sodium aluminate (41° Baumé). The molecular proportions in this solution between Na_2O and Al_2O_3 are as 5 to 6. The reaction takes place in autoclaves at 150° C. under pressure. Serpek proposes to first change the bauxite to nitride as above described and then collect the ammonia given off by the treatment with aluminate. The solution of the latter does not need to be stronger than 21° Baumé, the concentration possessed ordinarily at the end of Bayer's process, and there is no need of a reaction under pressure. The alumina obtained is quite free from iron and from silica. He finds a pronounced economy in the manufacture of both final products, alumina and ammonia.

RESULTS AT NEW FRENCH FACTORY.

As the direct manufacture of nitride is now carried on in the new French factory, it is practically continuous. Bauxite and coal are fed at one end of the revolving furnace. At the other end nitride is withdrawn in a finely granulated form, with 26 per cent of nitrogen. The rapidity of absorption depends upon the temperature. At $1,500^\circ$ the charge absorbs 18 per cent of nitrogen in 2 hours; at $1,600^\circ$, the same amount in $1\frac{1}{2}$ hours; at $1,700^\circ$, 25 per cent in 45 minutes; at $1,750^\circ$, 30 to 34 per cent in 20 minutes. The above results are secured when using a very high grade of bauxite. There are two very pronounced factors: The first is the ease with which impure nitrogen, as in the form of generator gas (77 per cent N, 23 per cent CO), can be used in the reaction. The second is the small amount of electric energy consumed. This amounts to only 10 or 12 kilowatt hours for each kilo of combined nitrogen. This is about one-half of what is required when nitrogen is combined in the form of cyanamide, and one-eighth of what is needed in the synthesis of nitric acid from the air.

The product is a hard bluish-gray mass that is slowly decomposed in moist air, giving off ammonia. When boiled with water nearly all the nitrogen present is liberated as ammonia and the aluminum is changed into hydroxide. It can be evaporated, changed into alumina, and used again in the operation; but it is doubtful whether this is as cheap as the use of bauxite.

PURE ALUMINUM NITRIDE.

Pure AlN contains 34 per cent of nitrogen and has been prepared by the Serpek process. Wolk has prepared it by heating the metal in ammonia gas. He finds that under these conditions the favorable temperature for combination is 850°C . Above $1,100^{\circ}$ dissociation begins. The lower the temperature at which the compound is formed the easier its decomposition by water. Fichter prepared the nitride in 1907 by heating aluminum in a nickel tube, traversed by nitrogen, at 740°C . He noted a quick reaction without any fusion of the metal and an abundant evolution of heat while the reaction took place. He states, however, that only two-thirds of the nitrogen was evolved as ammonia on treating with water and that treatment with an alkali was needed to change all of the nitrogen present into ammonia.

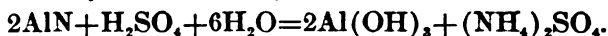
THE "BADISCHE" INVESTIGATION.

The Badische Anilin- und Sodafabrik has also investigated the technical possibilities of aluminum nitride, and regards it as having a distinct future. It finds that it is possible (German patent appl. B. 54832), in ordinary fuel furnaces, to secure easily and quickly, from the action of nitrogen upon mixtures of alumina and coal, a nitride of fairly high percentage, provided that certain other oxides are present to the extent of 5 to 10 per cent. The oxides of chromium, uranium, cerium, beryllium, vanadium, molybdenum, zirconium, titanium, and silicon all exert this favoring influence. Preference is given to silica on account of its cheapness, but under certain local conditions the other oxides may be advantageously employed, especially as they are recovered at the close of the operation and can be used repeatedly. The crude nitride often contains phosphides, carbides, silicides, etc., which affect materially the safe storing, transportation, and use of the material. The "Badische" (German patent 237436) proposes to obviate this inconvenience by treating the crude product with weak acid or oxydizers. These decompose the phosphides, etc., but do not attack the nitride to any serious extent.

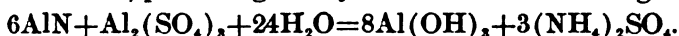
OTHER "BADISCHE" PATENTS.

In another series of patents (German patents 235300, 235765, 235766, and 235868) the "Badische" elaborates methods for handling the crude nitride with special reference to utilizing the aluminum present while effecting at the same time a complete change of nitrogen into ammonia. In the case of mixtures of AlN with other nitrides, more particularly silicon nitride, it is found possible so to treat the crude product with limited amounts of acid or alkali that the aluminum nitride alone is decomposed and yields soluble aluminum compounds along with the ammonia. A very pure form of alumina, well adapted for the manufacture of metallic aluminum, is secured from exceedingly impure nitride—made from low-grade bauxite—by first treating the crude material with water or steam, and then adding caustic alkali and heating in an autoclave with constant agitation. The molecular ratio of AlN to NaOH is 1 to 1.5. The temperature is maintained at 120° to 130°C . Ammonia is drawn

off from time to time and the last traces are removed by boiling under reduced pressure. From the resultant solution very pure aluminum hydroxide is precipitated by the addition of small amounts of the crystallized hydrate under agitation. The solutions obtained by treatment with either acid or alkali, which contain aluminum compounds, freed from the impurities of the original bauxite, serve admirably for the preparation of alums and double salts of aluminum. They require simply the further addition of the requisite amount of acid and base. By using a limited amount of acid it is likewise possible so to decompose the nitride that an ammonium salt and aluminum hydroxide result, thus:



Two reactions seem, however, to occur side by side in this change. First, a portion of nitride is transformed into salts of both ammonium and aluminum. Then the latter salt reacts upon the undecomposed nitride, producing the hydroxide in the following manner:



It is therefore technically feasible to use a solution of aluminum sulphate in decomposing crude nitride so as to secure alumina as a by-product.

BORCHERS AND BECK PATENT.

Simultaneously with the development of the Serpek method of producing aluminum nitride, Dr. W. Borchers and E. Beck, of Aix la Chapelle, originated and patented, in 1906 (German patent 196323), a general process for manufacturing metallic nitrides that promises to be of some importance as an additional means of transforming atmospheric nitrogen into compounds of commercial value. No manufacturing plant has as yet been established for the technical exploitation of the patent rights.

The process is intended principally for use in making aluminum nitride, but it can be employed with the alkaline earth metals, calcium, barium, strontium, and magnesium, and also with cerium and the allied rarer metals. Instead of isolating these metals, as a preliminary step to bringing about the direct union with nitrogen, it is found possible, and technically more economical, to obtain them in the form of alloys by the electrolysis of their oxides or halogen salts in the presence of a fused metal having good solvent power for the metals to be changed to nitrides. The change is then easily effected by exposing the resultant alloy at the proper temperature to the action of the nitrogen gas.

It will be noticed that at one stage in the evolution of the process Serpek also secured the final combination of metal and nitrogen by bringing the latter in contact with an alloy of the former.

The operation is effected by introducing the oxide or a halogen salt—preferably the chloride—of one of the metals enumerated above into a molten mixture of two or more salts, such as the chloride or fluoride, of the alkaline metals, or metals of the alkaline earths to which a chloride or fluoride of the metal in question has been added. Fluorides are used preferably on account of the greater solubility therein of the various oxides.

This fused mass, contained in an inverted cell of refractory material, rests upon the surface of a layer of a fused metal, such as tin, which covers the bottom of an open vessel mounted over a furnace. The last-mentioned metal should be one that forms with the metal to be changed into nitride an easily fusible alloy, and which also exercises a maximum solvent effect upon it. This layer of molten metal serves as the cathode terminal of a strong electric current. One or more plates of a difficultly fusible metal or carbon rods immersed in the fused salt mixture form the corresponding anodes.

Tubes allow the entrance of nitrogen, under pressure, beneath the surface of the molten metal serving as cathode. These currents of nitrogen strike against metal plates, placed obliquely in the molten cathode metal, and keep it constantly in motion, so that fresh portions continually come in contact with the supernatant layer of fused salts in the inverted anode cell.

As an example of the working of such a device, we may suppose that magnesium nitride is to be manufactured. In that case, tin or an alloy of tin and magnesium is employed as cathode. The surface of the molten cathode rises an inch or two above the lower rim of the anode cell, both inside and outside.

In this cell is introduced a mixture of magnesium fluoride and of sodium fluoride, in approximately molecular proportions (in order to lower the fusing point). The anodes are located within a short distance of the surface of the cathode metal. The current is then turned on and the resultant arc soon brings the salts into fusion. More of the salt mixture is added, until the lower ends of the anodes are distant 1 centimeter from the surface of the cathode, and are partly immersed in the fused mass. From this point on, magnesium oxide is continually added to the anode cell, the rate being regulated by the strength of the current. For each ampere there should be added 0.01 milligram of magnesium oxide or its equivalent. Under the action of the current metallic magnesium is liberated and is dissolved promptly in the cathode. Nitrogen is then forced intermittently or continuously into the latter. Magnesium nitride is formed and collects on the surface of the cathode outside of the anode cell, and is removed from time to time. The gases evolved on the anodes (oxygen, halogens, carbon monoxide) are led off through an exit pipe. The operation, once started, can be carried on indefinitely. Magnesium oxide or chloride is fed into the anode cell, and magnesium nitride is collected from the surface of the cathode.

If the magnesium nitride formed as above described be treated with steam, but not in excess, anhydrous ammonia and anhydrous magnesia (magnesium oxide) are produced. The former can be used as such or be transformed into ammonium salts. The latter can be used over and over again in the electrolyzer.

This means a continuous transformation of atmospheric nitrogen into commercial ammonia without the consumption of material, the essential cost being that of maintaining the electric current and of keeping the cathode metal in fusion. As stated above, aluminum compounds are well adapted for the reaction.

STATUS OF THE SERPEK PROCESS.

Of all the processes above outlined that of Dr. Serpek is the only one that has been tried upon a sufficiently extended scale to warrant its recognition as an industrial method with a distinct future. The Société Générale des Nitrures has been organized at Paris with a paid-up capital of nearly \$600,000 for the sole purpose of exploiting the Serpek patents. The company has also purchased the patents of the Badische Anilin- und Sodafabrik, described above, and for the time being seems to control the nitride field. It has constructed a plant in the Savoy district capable of producing 30 tons of aluminum nitride daily, which corresponds to an annual production of about 2,400 tons of combined nitrogen and over 12,000 tons of ammonium sulphate. This latter figure is slightly over 1 per cent of the world's present annual production of ammonium sulphate and 23 per cent of the production in France.

E. Kohn-Abrest states (Bull. Assoc. Chim. Sucr. et Dist., 1911, p. 1010) that the total cost of production at the works when made from bauxite is 55 centimes per kilo of nitrogen (4.8 cents per pound). In pure 34 per cent AlN , made from alumina, the nitrogen costs 1.04 francs per kilo (9.2 cents per pound). As both of these products are now offered for sale in France it is possible to make a comparison between the costs of nitrogen in the nitride form and in the current commercial compounds. Prices in 1911 were as follows: Crude aluminum nitride, \$0.065 per pound; pure aluminum nitride, \$0.118 per pound; Chile saltpeter, \$0.13 per pound; ammonium sulphate, \$0.145 per pound; calcium cyanamide, \$0.101 per pound.

COST OF PRODUCTION.

The French chemist, G. L. Bougerel, has made a somewhat exhaustive study of the cost of producing aluminum nitride (Mon. Scient., 1911, p. 561), which, while based largely on theoretical considerations, and especially on thermal values, still offers valuable approximations to what may be the more favorable results of actual practice.

In the first place, Bougerel analyzes the cost of nitride when produced as an adjunct to the preparation of pure alumina for use in manufacturing aluminum as patented by Dr. Serpek. For this purpose it is necessary to use a white bauxite containing only small amounts of iron. This mineral has the following average composition: Al_2O_3 , 74.8 per cent; Fe_2O_3 , 3.5 per cent; SiO_2 and TiO_2 , 8.8 per cent; H_2O , 12.9 per cent. In order to secure 1,000 kilos of alumina it is necessary to employ 1,336 kilos of such a bauxite. From this quantity 275 kilos of ammonia can be secured by utilizing Serpek's process.

To reduce the above-mentioned quantity of bauxite it is necessary to use 395 kilos of coke at 92°C . The reaction requires 225 kilos of nitrogen. To prepare this from air in the form of generator gas 56 kilos more of coke are needed. The time required to fuse 1,336 kilos of bauxite in an electric furnace of 1,000 horsepower is very nearly three hours. At the current rate in France of 70 francs (\$13.51) per electric horsepower year this item would be 24.15 francs

(\$4.66). The actual expenditure for heat to effect the reduction of ammonia is estimated at 41.06 francs (\$7.92). For heating the nitrogen to the reaction temperature and for loss by radiation there is another item of 6.26 francs (\$1.21). This represents a total outlay for fuel of 89.47 francs (\$17.27), but does not bring into consideration electrode waste of the heat evolved in the combination of aluminum and nitrogen.

As compared with the Bayer process for producing pure alumina from bauxite there is an economy of fuel amounting to 12.32 francs (\$2.37), due to the limited degree of evaporation of solutions involved in the Serpek process. The concentration from 32° to 45° Baumé is avoided. On this basis 1 kilo of nitrogen would cost 0.34 franc (6.6 cents per pound).

SIMULTANEOUS MANUFACTURE OF PURE ALUMINA.

This combination of the nitride process with the preparation of pure alumina for the aluminum works would seem to offer beyond question an exceptionally cheap source of synthetic ammonia. Unfortunately it is dependent upon the demand for metallic aluminum. The world's consumption at present is a little over 25,000 tons, of which France produces 6,000 tons. If this quantity were made from alumina, prepared by Serpek's process, it would permit the cheap production of 11,000 tons of combined nitrogen from the air, equivalent to 71,000 tons of Chile saltpeter. France would produce about 3,700 tons of this amount of nitrogen, equivalent to 18,000 tons of saltpeter, less than 4 per cent of her present consumption of that material.

It is evident that Serpek's proposed union of alumina production with that of ammonia, while resting upon an admirable technical basis, is seriously restricted, for the time being at least, by the world's demand for aluminum. It has a distinct field, within the limitations of the figures above given, and with the rapidly growing consumption of aluminum, especially for electric transmission, this field will be enlarged. For the moment this phase of Serpek's work is a comparatively unimportant factor in the general question.

COST OF NITROGEN BY ALUMINUM-NITRIDE PROCESS.

Of more interest is the estimated cost of nitrogen by the aluminum-nitride process, without attempting to utilize alumina, as above indicated. Bougerel makes the following calculation:

The bauxite now used, containing 74 to 75 per cent of Al_2O_3 , costs in France 12 francs (\$2.32) per ton at the mines, and on an average double that sum when delivered at factories. While there is actually 74 per cent of Al_2O_3 present, there is also a large amount of SiO_2 , which in the furnace forms a double silicate of iron and aluminum and withdraws a certain amount of Al_2O_3 from the reducing action. This loss Bougerel places at 15 per cent, and he regards the bauxite as containing on an average only 59 per cent of Al_2O_3 , available for the nitride reaction.

This estimate seems exaggerated. Calculation shows that if a bauxite having the composition given above (74.8 per cent Al_2O_3)

is changed into a nitride carrying 25 to 26 per cent of nitrogen, as is currently done at Serpek's works, practically all of the aluminum has assumed the form of nitride. It is also highly probable that SiO_2 may take part in the reaction to some extent and form nitride in accordance with the reactions patented by Sinding-Larsen and Storm, which have already been described. Serpek, in fact, makes provision in his furnace for the liberation of silicon and its distillation.

On the assumption, however, that only 59 per cent of Al_2O_3 is available in this bauxite, the following sums up the main items in the production of aluminum nitride, without, however, covering electrode wear, labor, general expenses, interest, etc.:

The cost of producing 1,000 kilos of combined nitrogen in the form of aluminum nitride (25 per cent) is as follows: Bauxite, 7.5 tons, delivered, \$34.74; coke, 2 tons, delivered, \$15.44; electric power, \$66.78; total, \$116.96, or about 5.3 cents per pound.

The cost of the electric power is divided as follows: Fusion of 7.5 tons of bauxite, \$26.20; heating to reaction temperature of 1,000 kilos nitrogen and the accompanying CO in generator gas, \$5.37; reduction of 4.44 tons of Al_2O_3 to Al, \$35.20; total, \$66.77.

If it is found that all of the Al_2O_3 in bauxite can be utilized in the reaction, as would seem most probable, calculation shows that the 7.5 tons of bauxite would absorb more nitrogen, to the extent of 254 kilos, at an additional cost for electrical power of 54.40 francs (\$10.50). In this case the cost per kilo of nitrogen would sink to 0.526 frac (4.6 cents per pound). This represents, however, the cost of nitrogen in a compound thus far not susceptible of direct use. It can easily be transformed to ammonia by the action of steam, and this, in turn, changed into commercial ammonium sulphate, for use as a fertilizer. The additional outlay involved in this sequence of changes should not bring the cost of nitrogen in the form of ammonium sulphate above 7 cents per pound, which is less than one-half of its present price.

ALUMINUM NITRIDE AS A FERTILIZER.

It is evident that if aluminum nitride could be used directly as a fertilizer and surrender even one-half of its nitrogen in the form of plant food, it would represent a great economy as compared with the cost of nitrogen in the form of Chile saltpeter or ammonium sulphate. Probably various experiments have been privately conducted by those interested in the future of the nitrides of aluminum and of silicon, but there has been no publication of detailed and authoritative results. The nearest approach to such an investigation was made in 1910 by Prof. Stutzer, of Königsberg, a well-known authority on fertilizers. He tested both silicon nitride and aluminum nitride as prepared technically. In a personal communication to me Prof. Stutzer states that he has not yet published any account of his experiments. Silicon nitride he found to be absolutely without value as a fertilizer. In the case of aluminum nitride there was a fertilizing action, but so limited that the compound could not be regarded as possessing any commercial value. There seemed, in his opinion, to be no adequate chemical power in soils to attack the

nitrogen present in the form of nitride and transform it into ammonia. No details were furnished as to the character of soil employed, the plants with which tests were made, the checks used, etc.

In the case of silicon nitride the result seemed natural, as that compound, according to most authorities, can not easily be decomposed by boiling water or steam. With aluminum nitride it appears more probable that the failure to secure positive fertilizing action in abundant measure was due to the ease with which the nitride is decomposed by water and ammonia liberated. One authority states that aluminum nitride is completely decomposed in a couple of weeks when exposed to moist air. It is quite possible that in the tests conducted by Prof. Stutzer the moisture in the soil acted too rapidly, ammonia was liberated in too large amount to be acted upon by the nitrifying bacteria, and it escaped into the air. In this case, it would appear desirable to experiment with the nitride in soils of a pronounced acid character, rich in humic acid.

There is also a field for experiment in seeking to find a suitable substance to mix with the nitride that will retard the decomposition with water. In the case of Norway saltpeter it was found necessary to overcome in a similar manner the very pronounced hygroscopic property of normal calcium nitrate. Again, it may be found feasible to obtain by the direct action of sulphuric acid on the nitride a preparation suitable for use as a fertilizer without incurring the expense of treating the crude material with steam and absorbing the ammonia thus liberated. It is a problem which may possibly be solved in a very cheap and simple manner. That there is a good basis for some such solution is to be inferred from a personal communication of the inventor, who informs me that his own experiments with aluminum nitrides as a fertilizer leave no doubt of its availability in this direction. The studies in this field have not yet been completed, and they are, in fact, quite subordinate to what seems to be the most promising utilization of the new compound, viz, the production of cheap ammonia. The nitride is now produced in an almost chemically pure form from bauxite at an expenditure of from 10 to 12 kilowatt hours per kilo of combined nitrogen. This is an expenditure of electrical energy, equivalent, as already stated, to but one-half of what is required to combine nitrogen in the form of calcium cyanamide and one-eighth of that employed in the nitrate works of Norway.

NITRIDE AS A SOURCE OF NITRIC ACID—SUPPLY OF BAUXITE.

Dr. Serpek adds that it has been found remarkably easy to oxidize the nitrogen of aluminum nitride to the form of nitric acid, and that this new feature is bound to change completely the prospect of the present methods for the manufacture of synthetic nitric acid and Norway saltpeter, as well as the future of the cyanamide industry. The evolution of the Serpek process may have a powerful influence in the solution of the nitrogen question; it can not offer a permanent solution, as the world's supply of bauxite is limited. There are deposits of considerable extent in France, Dalmatia, Carinthia, Ireland, Canada, and Arkansas; but much is of low grade and not well adapted for the purpose in question.

CALCIUM CYANAMIDE FROM ATMOSPHERIC NITROGEN.

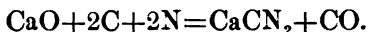
The first stages in the development of the cyanamide industry have been noted in detail in connection with the production of cyanides from atmospheric nitrogen. The discovery in 1901 by H. Freudenberg, acting under the direction of A. Frank, that calcium cyanamide could be successfully used as a nitrogenous fertilizer opened up at once a boundless vista for the future of the modest industry based upon the Frank and Caro patents of 1895-1898. It was promptly recognized that a possible solution of the nitrogen problem was presented, and every effort was exerted to perfect the process and create a world-wide industry. The technical advance made since then has aimed at securing the highest possible absorption of nitrogen by calcium carbide, at cheapening the cost of nitrogen—i. e., the removal of oxygen from air—at producing calcium carbide more economically, and at obtaining a commercial product closely adapted to the demands of agriculture.

THE CYANAMIDE REACTION.

There have been three distinct phases in the technical evolution of the present standard process, following upon the discovery that calcium carbide could absorb nitrogen. The first was the attempt to secure the final product by the direct action of nitrogen on carbon and lime; the second, the use of various salts to facilitate the reaction; and the third, the return to a process based exclusively upon the use of nitrogen and carbide.

MANUFACTURE FROM LIME AND COKE.

The attempt to simplify the production of cyanamide by heating lime and coke in an atmosphere of nitrogen had much in its favor. At the time when it was introduced the price of carbide had been forced to an excessively high figure. There seemed much of promise in the simple reaction



The manufacture on this basis proved feasible, and was pursued for a short time. The chief difficulty encountered was the impossibility of securing a sufficiently abundant absorption of nitrogen. The percentage of the latter did not amount to more than 12 to 14 in the final product, which thus contained only 34 to 40 per cent of calcium cyanamide. By the action of nitrogen on calcium carbide it was possible to secure a product containing 20 per cent of nitrogen and even more. The price of carbide fell and, there being no longer any economic hindrance to its use as a raw material, the attempt at direct production was abandoned.

USE OF CALCIUM CHLORIDE—THE POLZENIUS METHOD.

It was observed as far back as 1894 by Moissan that pure calcium carbide could not absorb nitrogen. The fact that the impure technical product, containing only 75 per cent of CaC_2 , was able to absorb the gas so abundantly early led to the view that the other matters present played an important rôle in effecting the assimilation of nitrogen. Numerous attempts were then made to ascertain whether other substances besides the ordinary impurities of carbide were capable of increasing the rapidity of absorption or the total amount of absorbed nitrogen.

In 1901 Polzenius, connected with the Gesellschaft für Stickstoffdünger, at Westeregeln, found that the chlorides of the alkaline and alkaline earth metals possessed a notable favoring influence (German patent 163320). Calcium chloride gave the best results.

A mixture of 62 kilos of technical carbide and 18.7 kilos of calcium chloride, when heated in nitrogen, yielded 100 kilos of crude calcium cyanamide, containing 19.3 per cent of nitrogen. Referred to the original weight of carbide, this meant an absorption of 31 per cent of nitrogen. The ordinary absorption by the earlier Frank-Caro process did not exceed ordinarily 25 per cent of the weight of carbide employed. The most important feature was the fact that the reaction could take place at a temperature as low as 700°C . (instead of $1,100^\circ$), and that it proceeded very rapidly. In later perfections of Polzenius's method mixtures of carbide with 10 per cent of calcium chloride yielded a product containing 23 per cent of nitrogen. The presence of calcium chloride in the product seems to have caused difficulty unless exposure to dampness was carefully avoided. When stored without such precautions moisture was quickly absorbed and ammonia was steadily lost. This loss amounted to over 1 per cent in the space of four months. Sacks in which the substance was stored were also attacked. The firm manufacturing cyanamide by Polzenius's method at Westeregeln became affiliated with the Cyanidgesellschaft, controlling the Frank-Caro process, in 1908, after a long struggle in the courts over patent rights; competition then ceased. Manufacture of Polzenius's cyanamide on a large scale began at Westeregeln in 1906. In 1910 it was discontinued, as the test of several years showed that the Frank-Caro process, in consequence of various improvements, was economically superior.

The exact nature of the influence exerted by the calcium chloride, sodium chloride, etc., in the cyanamide reaction is still imperfectly known. F. Carlson proposed in 1906 the use of fluorspar, CaF_2 , instead of calcium chloride. Very careful experiments in 1909 by F. Foerster and H. Jacoby show that this compound possesses distinct advantages over CaCl_2 in this connection. The favorable temperature for the reaction is not lowered as much as when CaCl_2 is used; it ranges between 800° and 900°C . Tests show that a relatively slight amount of the fluoride suffices. With 3 per cent the reaction is remarkably uniform and free from violence. The lining of the furnaces is also less subject to attack than when CaCl_2 is employed. The final product is notably less hygroscopic. Thus, comparative experiments were made, by exposure to the air for 41 days in thin layers, on a sample containing 5 per cent CaCl_2 and 19.8 per cent N, and one containing 5 per cent CaF_2 and 21.6 per cent N, with the

following results: Gain of weight through absorbed water, 33.5 per cent in the case of the CaCl_2 sample and 8.9 per cent in the case of the CaF_2 sample; loss of nitrogen, 6.1 per cent by the CaCl_2 sample and 1.6 per cent by the CaF_2 sample.

THE SCHICK PROCESS.

The helpful influence of both salts is ascribed to a lowering of the temperature at which the crust of cyanamide, formed about particles of carbide, softens and allows admittance to nitrogen. Chemists are, however, still at variance about the real nature of the reaction. Although the manufacture of cyanamide with the aid of CaCl_2 has been abandoned, and the use of CaF_2 has not been adopted, it is possible that a field for such agencies in the young industry may still be found. K. Schick, connected with the firm at Westeregeln, recently patented a method (French patent 430060), in which he adds salts of the above character to fused carbide as it leaves the furnace. The solidified material is exposed to the action of nitrogen when cooled to the favorable temperature.

THE PRESENT METHOD.

The inventors of the cyanamide process have now succeeded in perfecting its details so that by careful attention to the mechanical condition of the carbide and to the proper utilization of the heat evolved by the reaction it is possible to attain great uniformity and regularity in the manufacture. A fundamental point is the avoidance of too high a temperature. Experiment has shown that above $1,360^\circ \text{C}$. technical calcium cyanamide, which contains one-half of the carbon originally in combination in calcium carbide, tends to recombine with this carbon and revert to the form of carbide. The exact turning point varies according to the nature of the carbide originally employed. Greater amounts of lime lower the degree of temperature at which reversion begins. It is due to this fact that carbide issuing directly from the electric furnace can not react with nitrogen. When solidified it is too compact to allow of satisfactory penetration by nitrogen gas. This renders a very careful and thorough grinding of the carbide an all-important factor in the manufacture.

APPARATUS.

As a result of many experiments retorts heated externally are no longer employed in the preparation of cyanamide. The operation is now carried on in relatively small drum-shaped ovens, each provided with a source of heat in its center, dependent upon the use of the electric current. These units are easily handled, are not expensive, and are comparatively long-lived. Such a drum is constructed of perforated iron plate and is inclosed in a jacket of poor conducting material, refractory brick, or the like. In its center is a block of carbon with electrical connections. This resistance block serves to supply the necessary heat to start the reaction. At the cyanamide works of Odda, the largest establishment in the world, there are 196 of these drums.

The manipulation at Odda is comparatively simple. A number of the drums are filled with calcium carbide, which has been carefully crushed, so that the average size of the fragments allows easy passage for nitrogen, combined with a maximum conductivity of heat. A series of such drums is introduced into a long chamber and the electric terminals of each drum are connected with the current. The doors of the chamber are then tightly closed. The air present is displaced by nitrogen, and connection is established with the reservoir of the latter so that a constant supply is maintained. A manometer controls the pressure. An electric current of 75 volts is then turned on and the absorption of nitrogen rapidly begins. At a certain stage the current is shut off. The reaction proceeds without further application of external heat until the absorption of nitrogen is complete, as shown by the manometer connected with the nitrogen supply.

The duration of such an operation is from 30 to 40 hours. At its conclusion the drums are withdrawn, placed on a grid, and allowed to cool for 8 to 12 hours. The contents form a black porous mass that occupies a smaller volume than the original charge of carbide. The cyanamide thus formed is readily removed, as it does not adhere strongly to the walls of the drum. It is immediately ground to a fine powder and packed in sacks. The product contains 20 per cent of nitrogen.

THE WORKS AT ODDA.

As operated at Odda, each drum or oven produces about 1 ton of cyanamide per week. The total capacity of the works is over 12,000 tons per annum. Nitrogen is supplied by a Linde machine, which yields 1,300 cubic feet per hour. The carbide employed is made in a factory immediately adjoining the cyanamide works. The plant consists of 12 furnaces, each of 1,400 kilowatts capacity, producing 7 to 8 tons of carbide daily. The annual output is over 32,000 tons. Limestone is quarried close by and burned in five kilns. Welsh anthracite, with 3 per cent of ash, is brought by water to the works. The average consumption of material per long ton of carbide produced is 2,000 pounds of quicklime and 7,300 pounds of anthracite.

At present cyanamide is manufactured nowhere so economically as in the well-appointed works of the Northwestern Cyanamide Co. at Odda. The location on the seaboard allows of cheap transportation for the coal used and for the final product. Lime is furnished on the spot. Labor costs about 13 cents per hour. The entire labor cost involved in the production of 1 metric ton of calcium cyanamide at Odda amounts to \$3. The waterpower supplying the electric current is the cheapest in Norway. The actual net cost was given to me as \$2 per horsepower year. Use is made of the Tysse River, which has a fall of over 1,300 feet in 3 miles. Its catchment basin is small—about 135 square miles—but the present regulation insures a minimum of 50,000 horsepower during the year, and this will ultimately be doubled.

The regulation involved the construction of a tunnel 2 miles in length. The power house is equipped with 7 sets of machinery, each unit having 4,500 horsepower. The current is conducted to Odda by cable under a pressure of 12,000 volts. Odda, like Notodden

and Saaheim, the seats of the Norwegian nitrate industry, has been suddenly changed from a small village to a modern industrial town.

REACTION BETWEEN NITROGEN AND CARBIDE.

Apart from the careful crushing of carbide to exactly the right size, the dominant feature of the manufacturing operation is the starting of the reaction between nitrogen and carbide in the center of the carbide charge. The procedure is as follows: When the carbon resistance block in the center of the drum has communicated sufficient heat to the surrounding layers of carbide to raise the temperature to 1,000–1,100° C., the active absorption of nitrogen begins. The reaction is, however, exothermic; heat is given off and this is communicated to the inclosing strata. They are raised to the reaction temperature, more heat is evolved, and the absorption of nitrogen gradually extends through concentric layers until finally the entire charge is converted into crude cyanamide. Soon after the reaction begins in the center the supply of electricity ceases. The heat developed by the successive stages of the operation, as it extends uniformly in every direction, suffices to bring every portion of the charge to the required temperature in the course of time. Nitrogen enters at all points in the outer layer, and is drawn toward the center to replace amounts absorbed. It is gradually heated as it nears the zone of actual combination, but checks too rapid a heating of the outer layers of carbide. There is thus a very delicate adjustment of thermal conditions, so that the temperature does not rise high enough to cause a reversion to carbide and free nitrogen, or to the degree at which fusion on the surface of carbide ensues and prevents the penetration of nitrogen; and yet sufficient heat is generated by the reaction itself to insure its extension throughout the entire charge of a drum. The proper moment to shut off all communication of heat by the electric current is all-important. It is by the careful coordination of these mechanical and thermal factors that it is now possible to secure good results without using chlorides or fluorides to facilitate the reaction by lowering the temperature.

MODIFICATIONS OF THE PROCESS.

The Cyanidgesellschaft outlines the essential features of the present method in the German patents 227854, 228925, and 241852. Provision is also made to avoid direct contact between the resistance block and the carbide charge, so as to reduce to a minimum the danger of fusing portions of the latter. The uniform penetration of nitrogen to all parts of the carbide charge is, likewise, facilitated by surrounding the latter with a layer of porous material, such as sand or cyanamide itself.

F. S. Washburn (American patents 999071 and 1009705 seeks to secure a freer circulation of nitrogen by using a holder of wire cloth or perforated plate to contain the carbide. He also incloses it in an envelope of combustible material, which, on subsequent carbonization, furnishes space for free circulation of the gas.

F. Carlson, who has done much to throw light on the cyanamide reaction, proposes (Swedish patent 26834) an entirely new method of effecting the combination. Finely powdered carbide is heated by

electrical agency to the favorable temperature and is sifted into a chamber containing nitrogen, also heated in advance. There are certain possibilities in this method of procedure which favor the production of high-grade cyanamide.

It is not impossible that during the next few years distinct improvements may be introduced into the process rendering it possible to procure uniformly a product with a higher percentage of nitrogen. At Odda the time for absorption varies from 30 to 40 hours. At the French works at Briançon, where 30 drum ovens are in use, the absorption period varies from 30 to 60 hours, and the product contains from 15 to 30 per cent of nitrogen. The absorptive power is, of course, largely affected by the grade of carbide employed, as well as by the purity of the nitrogen. The latter is supplied at Briançon by both the Linde and the Claude machines.

NITROGEN SUPPLY.

Experience has shown that it is of prime importance to have a supply of dry nitrogen as nearly pure as possible. The presence of moisture or of oxygen involves naturally a loss of carbide. The same is also true for carbon monoxide and carbon dioxide. Both decompose carbide with formation of lime and carbon. Generator gas can not, therefore, be used directly in this reaction, and here the aluminum nitride industry has a distinct advantage over that of cyanamide.

THE CARO AND LINDE PROCESSES.

Caro has devised a method for securing fairly pure nitrogen from generator gas by passing it over a mixture of copper and cupric oxide for the simultaneous removal of oxygen and the oxidation of carbon monoxide to the form of dioxide, which is of interest in this connection. The resultant gas is easily freed from dioxide by passage through the customary absorbents. Nitrogen prepared by this method is fairly cheap, but thus far it seems possible to secure fairly pure nitrogen most economically by the fractionation of liquid air. Both the Linde and the Claude machines have been highly perfected during the past few years.

Where it is possible to utilize at the same time a supply of oxygen, the production of nitrogen is now exceedingly cheap. The expense is, however, slight when no attempt is made to utilize the oxygen. With a Linde machine specially constructed for the needs of the cyanamide industry, furnishing 300 cubic meters per hour, the cost of nitrogen (without including interest and depreciation of plant) is 1½ pfennigs per cubic meter (0.15 cent per pound). A machine yielding 3,000 cubic meters hourly supplies nitrogen at one-half the above cost. It is evident that at such rates the cost of pure nitrogen for the manufacture of cyanamide becomes quite insignificant.

Perfections are constantly introduced in the general method of fractionating liquid air for the production of nitrogen: Mewes (German patent 179782) carries on the distillation in vacuum, with an increased yield of pure nitrogen; Jänecke (German patent 220270) uses as cooling agent liquid air itself in place of liquid oxygen; Blau (German patent 223843) adds to liquid air a small amount of liquid

oxygen, and uses the latter also to cool the upper part of the column and secure a more complete condensation of nitrogen.

CYANIDGESELLSCHAFT METHOD—OTHER PROCESSES.

At the outset nitrogen was prepared for this manufacture by passing air over heated copper shavings, oxygen being removed by reaction with the metal to form cupric oxide. This oxide was subsequently changed back to metal by heating it in a current of reducing gases, such as water gas and coal gas. At present the majority of cyanamide works employ nitrogen separated from liquid air by fractionation. A few still make use of the copper method. The Cyanidgesellschaft (German patent 218671) has perfected its apparatus for this purpose so that it works with great uniformity and economy. Use is made of a double retort, one tube passing through another. Both tubes are charged with copper shavings, and they serve alternately for oxidation and for reduction as currents of air or reducing gases pass now through one and now through the other tube.

Two other recent tentative processes for securing nitrogen by removal of oxygen from the air through chemical agency might be mentioned. G. Kassner (German patent 233383) effects the absorption of oxygen by the use of alkaline manganates or permanganates, mixed with plumbates. These are heated and treated alternately with currents of steam and air. The Nitrogen Co. (English patent 24413) accomplishes the removal by passing dried air through fused potassium or sodium cyanide kept at a temperature of 500° C. The resultant cyanate is reduced back to cyanide by the action of metals or carbon. The mechanical operation is such that the operation is continuous.

CARBIDE SUPPLY.

While the problem of supplying nearly pure nitrogen at a very cheap rate has been so satisfactorily solved, the question of securing calcium carbide of a high degree of technical purity at a minimum of expense constitutes a most important factor in the new industry. The power of absorption varies very greatly between the different grades of carbides, quite apart from the actual percentage of CaC_2 present. It is very materially affected by the character and quantity of the impurities in the raw material. The physical properties exert likewise a marked influence upon the nature of the reaction. A very pronounced difference in absorptive power is noticed between carbides of identical chemical composition, made, however, in dissimilar types of oven. This property is altered, also, when carbide has been stored for some time. It is evident, therefore, that the manufacture of cyanamide, simple as the fundamental reaction appears, demands as close a supervision and analytical control of the raw material used as is exercised in the case of ores destined for the production of the finest grades of steel.

COST OF PRODUCTION.

The cost of carbide employed is of serious moment in influencing the future of the young industry. In order to combine 1 ton of nitrogen into the form of 20 per cent calcium cyanamide, 4 tons of calcium

carbide are required. From what is stated above it is obviously desirable for producers of cyanamide either to manufacture carbide themselves or to exert a very close control over the manufacture of the material used by them. There is also a distinct advantage in having a cyanamide factory immediately adjacent to carbide works.

The manufacture of carbide is almost as young an industry as that of cyanamide, and the highest degree of economy in its production is probably yet to be attained. The use of Erlwein and Engelhardt's induction furnace (German patent 206175) in place of the customary electric furnace avoids all waste of electrode carbon, assures a more uniform heating, and promises a greater economy of electric power, combined with a higher grade of carbide. According to Conrad, the best works now produce carbide at an expenditure of 4 kilowatt hours per kilo. In one of the best-equipped French works, using ovens of 1,000 horsepower, Pitaval in 1908 found the cost of production to be as follows for 1 ton of carbide: Lime, 940 kilos, \$2.72; coke, 650 kilos, \$6.18; electrode waste, 40 kilos, \$3.47; labor, \$1.45; repairs, \$0.58; electric current, \$7.72; general expenses, \$3.86; total, \$25.98. This is equivalent to \$23.57 per short ton. The actual cost at Odda, with its cheap electric power, lime, and carbon, would on this basis scarcely exceed \$19 per short ton. The minimum cost in the best works was estimated at \$37 per short ton in 1903 and at \$92 in 1897. These estimates do not include packing. The sheet-iron cylinders used at Odda for this purpose cost \$6 per ton of carbide.

The average wholesale price of carbide in German works since 1900 has been as follows: 1901, \$71.40 per metric ton; 1902, \$48.80; 1903, \$65.45; 1904, \$59.50; 1905, \$54.75; 1906, \$59.50; 1907, \$66.65; 1908, \$59.50; 1909, \$45.20; 1910, \$40.45; 1911, \$38.10.

WORLD'S CARBIDE PRODUCTION.

As a rule the countries possessing relatively cheap electric power have established carbide works more rapidly than has been warranted by the demand. There has been overproduction, and prices have been artificially maintained by the aid of syndicates. The following table shows the capacity of the works operated in different countries and the actual production during 1909:

Countries.	Number of works.	Horse-power.	Capacity.	Production.
			<i>Metric tons.</i>	<i>Metric tons.</i>
Austria-Hungary.....	6	35,000	35,000	30,000
France.....	12	52,000	50,000	30,000
Germany.....	5	9,700	12,000	9,000
Italy.....	9	46,000	50,000	35,000
Norway, Sweden.....	8	70,000	102,000	65,000
Spain, Portugal.....	12	20,000	12,000	12,000
Switzerland.....	12	66,000	44,000	30,000
United Kingdom.....	2	5,000	2,000	1,000
Canada.....	3	15,000	10,000	10,000
United States.....	2	60,000	40,000	40,000
Argentina.....	2	2,400	1,600	1,600
Japan.....	1	1,200	800	800

The introduction of cyanamide manufacture has been welcomed by all interested financially in the carbide industry as offering the prospect of a much larger field for the use of the material than is

afforded by the current demand for acetylene for purposes of illumination or for autogenetic welding.

Despite the fact that the existing carbide factories are not working as a rule to their full capacity, new works are constructed each year. Among the latest projects are large plants in Mexico and in the Transvaal to meet local requirements and avoid the heavy freight charges upon the present supply. Acetylene is admirably adapted for the lighting of mines and finds an extended use in countries where mining interests predominate. Numerous owners of coal mines in Silesia have recently combined to construct a large carbide factory in competition with the European syndicate which has its headquarters at Paris.

COST OF MANUFACTURING CYANAMIDE.

Little is known as to the exact cost of producing cyanamide. Pitalval stated, in 1909, that the French factory was able to manufacture it at a cost of \$32.22 per short ton. The product was then selling for \$40.27 per short ton. Under the present conditions at Odda, carbide being figured at \$9 per short ton and nitrogen by the Linde process at \$3, the following is the estimated cost of 20 per cent cyanamide per short ton under the most favorable conditions: 400 pounds of nitrogen, \$0.60; 1,800 pounds calcium carbide, \$15.20; labor, \$3; electric current, \$1; general expenses, \$2.20; total, \$22.

This represents a cost of 5.5 cents per pound of nitrogen in the combined form, and is little over one-third of the current cost of Chile saltpeter or ammonium sulphate. The margin is large, with a prospect of still greater economy in the future. It is evident that more expensive sources of electric power can be utilized in the manufacture than the waterfalls of Scandinavia or the Alps without bringing the total cost up to that of the standard forms of combined nitrogen.

CONSUMPTION OF ELECTRIC CURRENT.

Frank and Caro have established the fact that the cyanamide process, as at present perfected, does not require more than 3 electric horsepower years per metric ton of combined nitrogen (or 2.7 electric horsepower years per short ton), as compared with 11 electric horsepower years in the case of synthetic nitric acid. This involves the consumption of current in producing carbide and in effecting the absorption of nitrogen. On this basis the cost of manufacturing 1 short ton of 20 per cent calcium cyanamide may be stated in a general way as follows: 400 pounds of nitrogen, \$0.60; 1,500 pounds of lime, \$2; 1,030 pounds of coke or coal, \$4.50; electrode waste, \$2.55; labor, \$4.10; general expenses, \$5.45; total, \$19.20. To this is to be added the cost of 0.54 electric horsepower year. The price would range from \$2 per year, as at Odda, upward. The other items are liable to slight local variations, especially for coal, labor, and general expenses.

Frank has demonstrated that one electric horsepower, when exerted uninterruptedly and without loss, should yield sufficient carbide to absorb 772 kilos of nitrogen. At present the most efficient carbide

works rarely attain more than 60 per cent of the theoretical yield. The future will probably see a higher approximation to the theoretical figure, as well as a more complete absorption of nitrogen in the cyanamide reaction. It is with this confident expectation that those interested in the new industry face the competition with synthetic nitrates.

USE OF CYANAMIDE AS A FERTILIZER.

Since the first attempts to use cyanamide in agriculture, objection has been made on account of the odor emitted by the product and on account of its tendency to form a fine dust. The presence of free lime causes this dust to attack the skin and the respiratory tract of those handling the material. As in the case of the hygroscopic nature of Norway saltpeter, it has been necessary to overcome these conditions by subsequent special treatment.

In the French cyanamide works this is effected by moistening the product very slightly and with great care, following this by very thorough mixing with a little tar or petroleum.

F. Carlson (French patent 404155) also moistens the ground product very slightly and then exposes it to a current of carbon dioxide, thus neutralizing the free lime.

The Stickstoffwerke G. m. b. H., of Spandau (German patent 219932), attain the same end by mixing the ground material very intimately with acid salts of the alkalies and alkaline earths. The addition is sufficient to neutralize all free lime and to decompose a small amount of cyanamide with formation of an ammonium salt. This product yields no dust.

The Ostdeutsche Kalkstickstoffwerke (German patent appl. O. 7003) mix asphalt with the crude cyanamide.

The Cyanidgesellschaft (German patent 225179) uses for the same purpose small amounts of fatty substances, animal, vegetable, or mineral, or similar substances that are insoluble in water.

The Bayrische Stickstoffwerke (German patent 231646) add a very slight quantity of water to the ground cyanamide and then forms it into blocks with the aid of very powerful compression. These blocks are reground. The powder is free from dust and keeps for a long time without decomposition.

Prof. Stutzer, the well-known agricultural chemist (German patent 226340), moistens the powdered material with molasses or with the sirupy liquid obtained by concentrating the waste lyes of cellulose factories, and then dries at a moderate heat. By this treatment the formation of dust is prevented and the alkalinity is neutralized by the combination of free lime with carbohydrates to form saccharates and analogous compounds. The sugar furnishes further a desirable food for the bacteria in the soil, which, as will be noted later, are indispensable in rendering cyanamide effective as a fertilizer.

THE CHIEF OBJECTIONS TO ITS USE.

It was hoped by the inventors a decade ago that by placing the cost per unit of nitrogen in cyanamide materially below that of nitrogen in the form of Chile saltpeter or ammonium sulphate, the new

fertilizer would be promptly adopted for agricultural use, especially in Germany, where the desire is especially keen to establish a domestic source of combined nitrogen. As a matter of fact, the recognition of the value of cyanamide has been slow and hesitating. This is due to two causes. In the first place, certain physical and chemical properties of the material have caused prejudice against its use; and, in the second place, there has been much uncertainty as to its exact fertilizing value generally and in specific cases.

The most notable drawbacks were due to the presence of free lime and undecomposed carbide. The hands of agricultural laborers suffered from contact with the particles of lime, and were also blackened by the free carbon. On account of the dusty character of the ground materials, more or less irritating matter was respired. Undecomposed carbide reacted with atmospheric moisture also, and there was a continual evolution of acetylene, a disengagement of heat, and from moisture and heat combined a certain decomposition of the cyanamide itself, with loss of nitrogen in the form of ammonia. The product of the Polzenius method, with its free calcium chloride, was also exceedingly hygroscopic, so that it seemed advisable to manufacture it in the spring only, and then apply it to fields with as little loss of time as possible. These drawbacks have been in large part removed by discontinuing the Polzenius method and by adopting various precautions, as enumerated above, to lessen the tendency to form dust, to limit hygroscopic action, and to neutralize the alkalinity. In spite of these recent improvements in the character of the commercial article, it is still distinctly less pleasant to handle than Chile saltpeter or ammonium sulphate.

Probably for some time it will be necessary to use the argument of less relative cost to render its use more popular and widespread. There, of course, the question of the actual value, as a fertilizer, of nitrogen in this particular form of combination comes to the fore. It is also accompanied by a consideration of whether the crude technical material contains other substances helpful or hurtful to plant life. With regard to the latter phase of the subject, calcium cyanamide offers much the same advantage for use in soils deficient in lime that has been observed in the case of Norway saltpeter or calcium nitrate.

POSSIBILITY OF DANGER FROM POISONOUS COMPOUNDS.

Technical calcium cyanamide, containing 20 per cent of nitrogen, contributes one-half of its weight in the form of lime, CaO , to the soil when applied as a fertilizer. Fears were entertained at the outset that during the decomposition of cyanamide in the soil poisonous cyanogen compounds might be evolved. That traces of such compounds do appear, especially at the beginning of the decomposition, seems practically certain. There is, however, no evidence that the amount is sufficient to affect plant life injuriously. The possibility of the formation of dicyandiamide through the action of water on liberated cyanamide, $\text{CN} \cdot \text{NH}_2$, seemed to offer more ground for fear, as this compound possesses very pronounced corrosive properties. It has, however, been demonstrated that this polymerization can not take place below 40°C ., and to only a limited extent below 50° . This may ultimately affect the use of the fertilizer in tropical regions. It has absolutely no bearing in temperate zones. Doubt was also ex-

pressed with regard to the liberation in the soil of acetylene from undecomposed carbide. Experiment showed here, also, that the gas had no noxious action on plant life. The question of the use of calcium cyanamide prepared by the Polzenius method and containing varying amounts of calcium chloride was also raised. With the exception of tobacco, which is sensitive to all chlorides, even to the small quantities in Chile saltpeter, no other crops seem to be affected by this salt any more than by the free use as a fertilizer of potassium chloride from the Stassfurt deposits. The claim of a more or less injurious action on growing plants when applied as a top-dressing seems to have more basis.

EARLY FIELD EXPERIMENTS.

The practical experiments on various crops in different soils under varying conditions, in direct comparison with other nitrogenous fertilizers, furnish, naturally, the most important material for gauging the genuine value of calcium cyanamide. Such experiments began in 1901 and have been carried on since then in all European countries. Conflicting results have been published, and it can not be claimed that the exact value of the new fertilizer has yet been definitely and clearly established. Each year brings, however, additional contributions, and the final status of the compound as a fertilizer will be fixed in the course of a short time.

The actual chemical changes it undergoes when introduced into the soil are fairly well established. When exposed to the combined action of moisture and carbon dioxide, calcium cyanamide, CaCN_2 , decomposes into calcium carbonate, CaCO_3 , and cyanamide, $\text{CN} \cdot \text{NH}_2$, i. e., ammonia in which 1 atom of hydrogen is replaced by the radical CN. This cyanamide apparently unites with water to form urea, $\text{CO}(\text{NH}_2)_2$. The latter, which forms so important a part of stable manure, undergoes the familiar decomposition leading to the liberation of ammonia, and its oxidation to nitric acid ready for assimilation by plant organs. It has been well established, especially by Loehniss, in Leipzig, and by Perotti, in Rome, that the entire cycle of changes involves the cooperation of bacterial life in the soil. That this was necessary for the final nitrification of urea, as in the case of more complex nitrogenous products of animal or vegetable origin, had previously been ascertained. The bacteria which are active in bringing about the successive changes are abundant in nearly all soils containing humus. Without their presence cyanamide is of little value, as has been shown by experiments on sandy soil and on the acid soils of certain moors which are almost destitute of such bacteria. It has been recommended to mix humus with cyanamide before it is applied to the soil and plowed under. Peat, which contains as much as 80 per cent of humus, and which has so marked an ability to retain ammoniacal matter, is especially valuable for this purpose.

Bohn in 1904 and Otto in 1905 showed that the maximum fertilizing effects were secured if cyanamide was applied to a field one to two weeks before the date of sowing the seed and was plowed in so deeply (3 to 4.5 inches) that it did not come in direct contact with the seed. As compared with Chile saltpeter, it was slower in

its action, but was much less liable to be removed from the soil by excessive rainfall.

The experiments made in 1901-1903 by Wagner, Gerlach, and Liechti, all authorities in agricultural chemistry, showed conclusively that in oat fields the nitrogen of calcium cyanamide was fully equal in fertilizing value to that of ammonium sulphate. Both were estimated as possessing in this connection but 86 per cent of the value of nitrogen in saltpeter. Von Knierin, of Riga, also made comparative experiments in 1905 with oat fields which showed the cyanamide to be even more effective than saltpeter.

WAGNER'S EXPERIMENTS.

In 1906 Dr. Wagner, of Darmstadt, after five years of experimentation, gave in substance the following opinion regarding the fertilizing value of calcium cyanamide:

My opinion is provisional only, as my investigations are not yet concluded. The nitrogen of this substance is changed in the soil with tolerable rapidity and completeness into ammonia and nitric acid, provided conditions are favorable. It possesses very nearly, if not quite, the effective value of ammonium salts. Favorable conditions are not present in all soils or every year. The action is uncertain on sandy soils deficient in lime but rich in humus, and on all soils of an acid character. It is not applicable on acid moor soils. It is not adapted for all plants. Its action is injurious to beets. The best results follow an application in February to winter wheat and rye. Here it is practically equal to ammonium salts. Definite conditions for securing certain results with cyanamide remain yet to be established. It certainly can never be used under all circumstances with the same certainty as saltpeter.

RECENT INVESTIGATIONS.

In 1906 Dr. Rösicke, of Gorsdorf, made comparative experiments on a large scale with rye, employing in similar fields equal amounts of nitrogen in various forms. The results were as follows: 502 kilos of grain were secured when no fertilizer was used, 750 kilos when Chile saltpeter was used, 604 kilos with ammonium sulphate, and 746 kilos with calcium cyanamide.

Dr. R. Otto, of the Royal Pomological Institute at Proskau, has published in *Gartenflora* interesting results of his comparative experiments in connection with potato culture. It was found that the two new fertilizers—calcium cyanamide and calcium nitrate—varied but little in their effects. Ammonium sulphate gave notably higher yields, while Chile saltpeter was the least effective of the four. Exceptionally heavy rain storms occurred, and it is possible that the Chile saltpeter may have been unduly leached from the soil.

In 1910 C. Ampola, the Italian agricultural chemist, published the data obtained in a variety of comparative experiments. Cyanamide was found by him to give satisfactory results with all crops and to be very slightly inferior to ammonium sulphate in the effective action of its nitrogen.

In 1910 J. König published the results of numerous comparative experiments in the vicinity of Wiesbaden. He was able to substitute cyanamide for nitrates or ammonium salts with good results in the case of all crops, but not in the case of all soils. In France, in 1909 and 1910, Prof. F. Laurent secured data from a group of planters

relating to the application of four different fertilizers in the cultivation of oats. The average increase in the value of the oat crop per acre, after deduction of the cost of the fertilizer, was as follows: With Chile saltpeter, \$8.59; with Norway saltpeter, \$6.41; with ammonium sulphate, \$6.45; with calcium cyanamide, \$9.90.

The most extended and valuable comparative study of the relative effectiveness of both calcium cyanamide and calcium nitrate, as contrasted with the standard nitrogenous fertilizers, has been conducted by Prof. J. Hendrick during the years 1905-1910 at the Aberdeen and North Scotland College of Agriculture. The results of his tests show in a very conclusive manner that when properly applied calcium cyanamide possesses a fertilizing value for cereals nearly equal to that of ammonium salts. The soil about Aberdeen is deficient in lime, so that calcium nitrate and possibly calcium cyanamide might be expected to give better results than sodium nitrate.

The British Imperial Institute expressed the opinion in 1911 that calcium cyanamide is practically equivalent in manurial value to ammonium sulphate on all fairly good soils, but inferior on poor moorland or sandy soil.

OTHER USES OF CALCIUM CYANAMIDE.

In addition to its use as a fertilizer calcium cyanamide has several minor applications of varying importance. The manufacture of cyanides from calcium cyanide by fusing with such a flux as ordinary salt has already been described.

It has been found possible to employ cyanamide with advantage instead of potassium ferrocyanide for transforming wrought iron into steel. Under the name of "Ferrodur" there is now a regular consumption of the material in Germany in connection with the manufacture of machine tools, drills, and armor plate.

The recent introduction by J. C. Clancy of the use of cyanamide to replace cyanides in the treatment of gold ores is regarded of great promise. He employs a solution of the following strength: 1,000 liters of water, 0.5 kilo of KCN, 1 kilo of KSCN, 1 kilo of CaCN_2 , 0.13 kilo of KI, and 10 kilos of NaCl. After use the original solvent is restored by the aid of electrolysis.

The preparation of dicyandiamide for use as a fertilizer has been mentioned above. There would appear to be a field of considerable importance for this compound in the manufacture of high explosives. While containing so large an amount of nitrogen—67 per cent—and affording relatively great pressure on combustion, it develops a comparatively small amount of heat. This limits the wear in the chambers of rifled weapons very materially. Dicyandiamide, and also one of its derivatives, nitrodicyandiamidin, are now regularly added to various nitroexplosives in order to lower the temperature during explosion; they replace ammonium oxalate for this purpose.

Urea is manufactured without difficulty from cyanamide, and a very practical method has been devised for its technical production by the Stockholms Superfosfat Fabriks Aktiebolag (German patent 239309). The synthesis of a number of other allied compounds, such as guanidine and creatin, is now a matter of great simplicity.

The calcium in the new compound is easily replaced by sodium or potassium. These salts react readily with phenylglycine and furnish an additional technical method for the production of artificial indigo.

MANUFACTURE OF AMMONIA.

For the present the most important property of calcium cyanamide is the ease with which it can surrender all of its nitrogen in the form of ammonia. The reaction takes place rapidly and quantitatively when the compound is treated with superheated steam. The liberated ammonia can be absorbed in sulphuric acid, and furnishes a very pure ammonium sulphate to commerce. It is in this ability to transform cyanamide at will into a staple article that the prospective development of the new industry finds its chief support.

As in the case of any new article time is required for the introduction of a new fertilizer. It is necessary to familiarize great numbers with its use and manipulation to overcome objections and all the difficulties attendant upon the popularization of a totally new material. During this period of probation and of education there is nothing to prevent the steady extension of the industry, apart from the direct demand of the product for use in agriculture. Any excess in production can be promptly converted into merchantable ammonium sulphate. It is necessary, to insure profit, that the margin between the expense of producing cyanamide and the market rate for the ammonium salt should be sufficiently large to cover the cost of the sulphuric acid employed, and the items of labor and fuel involved in the conversion.

The change of 1 pound of nitrogen from the form of cyanamide to the form of ammonium sulphate demands the equivalent of exactly $3\frac{1}{4}$ pounds of concentrated sulphuric acid, H_2SO_4 . The present average cost of producing sulphuric acid in Germany is 0.313 cent per pound (of H_2SO_4). This would involve an outlay, per pound of nitrogen, of at least 1.1 cents for acid and a much less amount for labor and fuel, as lime and carbon are regenerated for the carbide process. A margin of 1.5 cents per pound in favor of cyanamide would seem to insure a remunerative conversion into the ammonium compound. The average variation in the current commercial rates at Hamburg during 1910 for nitrogen in the two forms was 1.93 cents per pound. The estimates, already furnished, of the actual cost of producing cyanamide under the most favorable conditions, viz, 5.5 cents per pound of nitrogen, would, however, offer a wide margin between that figure and the current commercial rate in Germany of 13.3 cents per pound for nitrogen in the form of ammonium sulphate.

The manufacture on an extended scale of ammonium sulphate from cyanamide has been organized in the Italian cyanamide factory at Piano d'Orta, and a Belgian establishment at Vilvorde is engaged in the conversion of the Norwegian product. The necessary equipment is being introduced into other cyanamide works. Several special methods are described for this purpose. The Oest. Ver. für Chem. and Met. Prod. (Austrian patent 42810) mixes a small amount of water with the cyanamide and then heats under pressure to $180^\circ C$. The escaping ammonia and steam pass through

a dephlegmator and the condensed water returns constantly to the still. The Bayrische Stickstoffwerke (German patent 236705) also add a slight amount of water and then treats in a current of steam under a pressure of 2 to 3 atmospheres. The reaction is quantitative and takes place without any formation of dicyandiamide, at relatively low temperature and pressure.

AMMONIUM NITRATE.

Evidently the ideal arrangement under existing circumstances would be to establish cyanamide works side by side with plants for producing synthetic nitric acid. The latter would be neutralized by ammonia generated from cyanamide, and the highly valuable ammonium nitrate, so easy to transport, could be manufactured at relatively less cost than any staple nitrate or ammonium compound. The chemists of the Norwegian nitrate works assure me that in some such consolidation of manufacturing interests they look for the economic ideal in the future organization of air-nitrate industries. An important factor in any such combination would be the utilization of the oxygen, separated in a concentrated form in the Linde machines of a cyanamide plant, to enrich the current of gas passing through an electric furnace and increase the output of nitrogen dioxide.

Collett and Eckhardt (Norwegian patent 19716) have devised a method for producing ammonia by the action of steam on a mixture of nitrates and cyanamides, which is more specifically adapted to the conditions of the nitrate industry in Norway. The same inventors (Norwegian patent 19973) claim to have perfected a process for transforming calcium cyanamide into an excellent fertilizer. The material is exposed at a somewhat elevated temperature to the combined action of steam and sulphur dioxide. As a result carbon dioxide is given off and a mixture in solution of calcium sulphate and ammonium sulphite is obtained:



Any calcium sulphide formed is removed by filtration and the solution is evaporated to dryness. Such a mixture is well adapted for use as a fertilizer. The reaction provides a distinctly less expensive method of securing the nitrogen of cyanamide in the form of an ammonium salt than that now in use, as two molecules of SO_2 are less costly than one molecule of H_2SO_4 .

GRAPHITE AS A RESIDUAL PRODUCT.

Mention should be made of the subsidiary products obtained when cyanamide yields up its nitrogen in the form of ammonia. If the decomposition is effected by the use of water under pressure in autoclaves, the carbon present in technical cyanamide and formed by the action of nitrogen carbide is liberated in the form of graphite. It can be separated from the accompanying calcium hydrate, and its value is such as to cover the cost of the operation. When cyanamide is decomposed by the action of superheated steam the residual mass of lime and carbon is in such condition that it can be employed again in the manufacture of carbide. Here also the cost of manufacture is largely defrayed by the value of the residue.

PRESENT STATUS OF THE CYANAMIDE INDUSTRY.**ORGANIZATION.**

While the cyanamide industry is not yet on an absolutely stable basis, its position in the ranks of recognized technical undertakings is steadily becoming more assured. That this is true is due principally to the efforts of Prof. A. Frank, to whom Germany is indebted for the organization on a scientific and technical basis of her present magnificent potash industry.

When it became evident that in the production of cyanamide there was promise of a great international industry the German capitalists interested in its development looked southward for cooperation, and arrangements were made with those controlling ample supplies of cheap water power in northern Italy.

In 1904 all parties concerned organized at Rome *La Società Generale per la Cyanamide*, with a capital of \$714,000, which has since been raised to \$882,000. The members were the *Cyanidgesellschaft*, of Berlin, and the three Italian companies—*La Società Elettrochimica Italiana*, *La Società Italiana per il Carburio di Calcio*, and *La Società Italiana di Prodotti Azotati*. The *Società Generale* took over all the patent rights, and has since then issued licenses for manufacture in different countries and exercised a general supervision over the development of the new industry. Its work is still evidently very largely of a pioneer and missionary character. A small dividend was declared in 1908, but there were no dividends for 1909 and 1910.

ITALIAN FACTORIES.

The establishment of cyanamide works in different lands has proceeded slowly. Obviously it was desirable, in order to avoid freight charges, that such works should be fairly well distributed wherever cheap electrical force was available.

In Italy the first large factory was organized by the *Società di Prodotti Azotati* at Piano d'Orta, on the Pescara, near the Adriatic. The capacity of the works has been increased so that it is now able to produce annually 10,000 tons. A good share of this is transformed into ammonia and ammonium salts. The manufacture has been established on a smaller scale by two other Italian companies—*La Società del Carburio di Calcio* at Collestatte, near Terni, and *La Società Piemontese del Carburio di Calcio* at St. Marcel, in the Province of Aosta. From all these sources it is reported that the new fertilizer gains ground but slowly in Italy. The capital of the *Società Prodotti Azotati* was recently reduced from \$2,123,000 to \$1,263,000.

ESTABLISHMENTS IN GERMANY.

In Germany there are likewise several factories. At Muhlthal, near Bamberg, are the works of the *Ostdeutsche Kalkstickstoffwerke* and *Chemische Fabriken G. m. b. H.* This company is controlled by the *Brandenburgische Carbidwerke* and the *Ostdeutsche Wasserkraftgesellschaft*, both of Berlin, which have a combined capital of \$833,000. The water power of the River Brahe is employed. The annual productive capacity is 40,000 tons.

A larger establishment has recently been equipped at Trostberg, in the mountains of southern Bavaria, where the water power of the Alz is utilized. The operating firm is the Bayrische Stickstoffwerke A. G. It was founded in 1908 by the Cyanidgesellschaft, of Berlin, in combination with several banking houses and industrial firms of Munich. The capital is \$1,640,000. The power house and the electrical equipment cost \$714,000; the carbide and cyanamide plant, \$476,000. The purchase of site involved an outlay of \$238,000. The water power exceeds 11,000 horsepower. Active manufacture began in April, 1911.

A third establishment at Knapsack, near Brühl, on the Rhine, is operated by the Actien-Gesellschaft für Stickstoffdünger, of Frankfurt, with a capital of \$571,000. The company was founded in 1908 by the Metallurgische Gesellschaft of Frankfurt and the Kons. Alkaliwerke of Westeregeln, near Magdeburg. It was at Westeregeln that the Gesellschaft für Stickstoffdünger began to manufacture under the Polzenius patents in 1906. The annual production reached about 5,000 tons. After the consolidation of the conflicting patent interests the company at Westeregeln disposed of its plant and rights to the new company operating at Knapsack and discontinued manufacture in 1910. The factory at Knapsack uses brown coal, or lignite, as a source of electrical power. It has a capacity of 10,000 tons a year. The financial experience of this company has not been very satisfactory. The original capital was \$476,000, and this was raised to \$857,000. At the close of 1909 it was necessary to write off \$286,000 for depreciation and losses. The report of the company for that year stated that expectations had been raised too high and that there had been a serious overproduction, with consequent carrying of stocks for a long period, while much of the plant stood idle. No report was issued for 1910.

Closely connected with the above is the Stickstoffwerke G. m. b. H., of Spandau, a company founded by the Cyanidgesellschaft and devoted exclusively to the manufacture of cyanides and other products, cyanamide being used as raw material.

The present annual production of the above works is about 40,000 tons, of which 15,000 tons is used in the further manufacture of ammonium salts, chiefly sulphate.

The sale of the cyanamide manufactured in Germany is in the hands of the Verkaufs-Vereinigung für Stickstoffdünger, of Berlin. This agency controls the sale of cyanamide in Germany, Austria, Russia, Denmark, and Holland. Its total sale for agricultural purposes in the above-mentioned territory amounted, during the year ending May 31, 1910, to 6,000 tons and to 15,000 tons during the following year. The manager informed me that he counts upon placing over 30,000 tons during the year ending May 31, 1912.

A similar agency is constituted by the Société Anonyme L'Azote, of Paris, which controls the sale in Belgium, France, Switzerland, and southern Europe. It represents chiefly the two producing establishments in France and Switzerland.

PLANTS IN FRANCE, SWITZERLAND, AND HUNGARY.

In France the Société Française des Produits Azotés began operating its works at Notre Dame de Briançon, Department of Savoy, at

the close of 1908. It possesses an equipment for manufacturing liquid ammonia and ammonium salts from cyanamide. The nitrogen plant supplies 120 cubic meters of the gas hourly. In 1909 there was a production of 900 tons. It rose to 4,000 tons in 1910 and there was a gradual increase in 1911. The French works furnish two grades. The first grade contains 15 per cent of nitrogen and sells at 210 to 220 francs per metric ton (\$36.77 to \$38.52 per short ton). This corresponds to 1.40 to 1.46 francs per kilo of nitrogen, or 12.3 to 12.8 cents per pound. The second grade contains 18 to 20 per cent of nitrogen and sells at the rate of 1.42 francs per kilo of nitrogen, or 12.5 cents per pound.

In Switzerland there is a factory owned by the French company and located at Martigny. It was opened at the close of 1908, and the capacity is about the same as at the French works.

In Hungary a cyanamide factory is projected at Fiume, but no attempt has yet been made to complete and operate the plant. Practically the same may be said of the project to connect a cyanamide plant with the carbide works of the Magyar Nitrogen Ipar at Sebenico, which still awaits realization. A more earnest effort has been made in 1911 to utilize for the purpose the water power of the River Chiese, in the Val di Daone. This has an estimated force of 24,000 horsepower. A company has been formed for the purpose. The estimated cost is about \$1,200,000. It is asserted that the demand in Austria-Hungary for cyanamide as a fertilizer has now reached 15,000 tons annually, but this estimate is probably too high.

NORWEGIAN, AMERICAN, AND JAPANESE CONCERNS.

The most important cyanamide works in Europe are undoubtedly at Odda, Norway. They are owned by the Northwestern Cyanamide Co. (Ltd.), of London, in which German and Italian as well as English capital is interested. Operations began in July, 1908. Details have been given regarding its equipment. The annual capacity is about 12,000 tons, and practically all of the product is exported. The export in 1909 was 752 tons; in 1910, 4,281 tons. It is said to have increased rapidly in 1911. The declared export value per metric ton in 1910 was \$42.88. This corresponds to a rate of 9.75 cents per pound of nitrogen.

The establishment of the American Cyanamide Co. at Niagara Falls, Ontario, completed in 1908, appears to be one of the most productive in the world, as it disposes of about 10,000 tons annually, largely for use in compound fertilizers. The works are arranged for a future enlargement so as to allow a production of 80,000 tons. A plant has been proposed for Mussleburg, Tenn.

In Japan, a native company, the Nippon Chisso Hyrio Kabushiki Kaisha, began operating works at Minamata in 1910. The company has a capital of 1,000,000 yen (\$498,000), and now plans to erect an additional plant in northern Japan, contemplating a total annual production of 40,000 tons. Most of the present production is sent to a factory at Osaka and there changed into ammonium sulphate. There is a very active demand in Japan for ammonium sulphate, especially for a perfectly white salt.

As the ammonia derived from calcium cyanamide is entirely free from the impurities present in the crude ammonia water of gas works, it is admirably adapted for the cheap production of white salt. The current price in Japan for 20 per cent cyanamide is \$57 per long ton, a much higher rate than prevails in other countries.

OUTLOOK OF THE CYANAMIDE INDUSTRY.

The above comprise the works actually organized and in operation. It would appear as if the facilities for manufacture are materially in advance of the present demand for cyanamide as a fertilizer. Unquestionably much capital has been invested in the new industry; Dr. Grossmann, who has studied the situation carefully, estimates the investments thus far at \$15,000,000. On much of it no dividends have been realized. The present tendency is evidently to develop the use of cyanamide as raw material for the manufacture of ammonia, and to make this, for the time being, the central feature of the new industry. There is every indication that this can be done easily and profitably. A large share of the output of the Odda works is now regularly shipped to Belgium for transformation into ammonia and ammonium salts. If there is an assured market for the entire product of the existing works, in the form of a staple article, the future development of the industry should be normal. Enlargement on the basis of ammonia production will be subject to the laws of supply and demand, coming into competition with the steady perfection of methods for securing the compound in increased quantities from coal, peat, etc. It would seem from the data above given that the manufacture could be developed for some time, at least, at very remunerative rates on this basis. The appearance of aluminum nitride as a promising source of ammonia, and the eventual establishment of Haber's process for synthetic ammonia on a technical basis may exert ultimately a distinct influence upon the future of the industry in this direction.

In the meantime opportunity will be afforded for cyanamide to win a recognized position as a nitrogenous fertilizer. The conditions under which it can be most advantageously employed for various crops, soils, and climates will be more definitely established each year. It is evident that it will take some time to determine accurately the exact value for agricultural purposes of nitrogen combined in this form. The opinion held a few years ago that it had only 80 per cent of the value of nitrogen in the form of nitrate is no longer maintained. The real future of the cyanamide industry depends upon the settlement of this question. Contemporaneously the efforts made to lessen or remove the physical drawbacks to the handling of the material will do much to remove the undesirable prejudice against the cyanamide. A material lowering of the price might accomplish much in overcoming the objection to its use, and such a lowering would be justified in bringing about an increased demand. To some extent this has been realized in Germany. The price per kilo of nitrogen in cyanamide was fixed at \$0.29 in 1906; in 1908 it was lowered to \$0.27; in 1909 to \$0.26; in 1910 to \$0.25. During 1910 the price of nitrogen in the form of ammonium sulphate was \$0.293.

EFFORTS OF GERMAN GOVERNMENT—COMPETITION.

Apart from the efforts made by those directly interested in the manufacture to extend the use of cyanamide as a fertilizer there has been more or less official action in this field by the German Government, which recognizes that the industry had its origin in the Empire, and may prove to be of distinct value as a national asset in relieving Germany from dependence upon Chile for its supply of combined nitrogen. At the instance of the Ministry of the Interior a report on the subject was furnished in 1910 by the Union of German Agricultural Experiment Stations. This report emphasized the physical drawbacks and dwelt upon the difficulty of using cyanamide as a top dressing, the necessity of application before the time of sowing, the average lack of effectiveness compared with the standard fertilizers, etc.

If ultimately a position of equality, or one of only slight inferiority, in meeting the needs of agriculture be conceded to cyanamide, its advantage as a rival of synthetic calcium nitrate must be recognized. It rests upon the relative consumption of electric power in the two manufacturing processes. At present 1 kilowatt hour yields 17 grams of nitrogen in the form of nitric acid by the union of atmospheric nitrogen and oxygen under the most favorable technical conditions; it yields 70 grams in the form of calcium cyanamide from nitrogen, coal, and lime.

In order to overcome this tremendous handicap, should the era of direct competition ever arrive, the yields of the new Norwegian industry must be trebled or quadrupled. When this epoch approaches there is, however, as already noted, opportunity for the competing interests to combine in making ammonium nitrate the joint product of their manufacture. It is to be noted in this connection that already a considerable degree of rivalry has developed in various European countries as efforts are made to introduce both calcium nitrate and cyanamide in place of the present standard fertilizers. There is likewise a marked attempt to conceal the actual condition of the cyanamide industry, to give the productive capacity in the place of the genuine production, etc. This is not possible in the case of Norway saltpeter, as it is nearly all exported, and the Norwegian customs statistics give a fairly accurate idea of the standing of the industry.

COAL WASTE AND PEAT AS SOURCES OF AMMONIA.

Any survey of the problem of the utilization of atmospheric nitrogen would be incomplete without consideration of the steps now being taken to secure in a commercial form the vast amounts of nitrogen derived originally from the air and locked up in the world's deposits of coal and peat.

Brief mention has already been made of the extent of this source of nitrogen and of the amount of ammonium sulphate now currently obtained from coal as a by-product, in connection with the manufacture of illuminating gas, the production of coke, the metallurgy of iron, and the treatment of bituminous shale. Each year witnesses a steady increase in the relative production of ammonia from these four sources. The fact remains, however, that in these various operations less than one-seventh of the nitrogen present in coal is actually rescued from loss. Every modification in the present methods of using coal as a source of energy, or of reducing action, by which there is an increase in the relative amount of nitrogen recovered, assumes at once decided economic importance.

AMMONIA FROM COAL.

MOND GAS.

Pioneer work has been done in this field by Ludwig Mond, who demonstrated on an industrial scale that the ordinary method of producing water gas could be so modified that a large amount of the nitrogen in the coal used could be recovered in the form of ammonia. The essential feature of the process, as patented in 1893, is to introduce steam, heated to 150°C. , in excess in the generators. The formation of gas takes place at a low temperature, and fully one-half of the nitrogen present in the coal used is obtained in the form of ammonia. A short ton of coal yields on an average 6.6 pounds of ammonium sulphate. The tar secured is of a superior quality, while the gas, after thorough washing, is admirably adapted for use in gas engines. The cost of the gas is lessened by the value of the ammonia recovered. This method has spread rapidly in England, where there are 60 plants for the production of Mond gas, using over a million tons of coal annually. Even without saving the ammonia the cost of producing water gas by the Mond process seems less than by that first employed. In order to render the recovery of the ammonia economically profitable, the plant must be of considerable size, generating at least sufficient gas for 5,000 horsepower. Of the English plants, 15 are equipped for the collection of ammonia. The yield of sulphate in 1909 was over 26,000 tons.

A large plant has recently been started by the Mondgesellschaft under the auspices of Caro, in Germany, at the colliery of Mont Cenis, near Sodingen, Westphalia, in which the process is highly per-

fect, and the amount of heat employed reduced to a minimum. The average yield in the works per ton of bituminous coal is 3,500 cubic meters of gas (of 1,100 to 1,200 calories), and 40 kilos of ammonium sulphate. This corresponds to about 75 per cent of the nitrogen present in the coal, and means a vast saving as compared with the results of the past.

Caro has further shown that the Mond process is applicable to culm and coal refuse (German patent 198295), and that the vast amounts of such waste material accumulating about coal mines can profitably be employed in generating power gas and ammonia. This refuse contains 30 to 35 per cent of carbon and about 0.9 per cent of nitrogen. By using a large excess of steam, equal in weight at least to the culm treated, it is possible to secure a gas of 1,000 calories, and 25 kilos of ammonium sulphate per ton of refuse. After employing sufficient gas for the evaporation of the sulphate solutions and for motive power, there remains an excess of 500 to 600 cubic meters per ton of refuse for use in engines, etc. The operation is carried on systematically at Mont Cenis. Equal success has attended Caro's attempts to use brown coal, or lignite, in the Mond process. The coal employed contains only 0.63 to 0.83 per cent of nitrogen. From 1 ton of coal he obtains 1,100 to 1,300 cubic meters of gas (of 1,300 calories) and 19 to 25 kilos of ammonium sulphate. No less than 95 per cent of the nitrogen originally present is recovered. A typical sample of the gas obtained from lignite contains 13 per cent CO_2 , 18.4 per cent CO , 22.8 per cent H , 3.6 per cent CH_4 , 42.2 per cent N . This phase of the development promises much for Germany and Austria with their enormous deposits of lignite.

APPLICATION OF MOND PROCESS TO PEAT.

Of even greater importance is the extension of the process to peat. Attempts to utilize peat deposits for the economical production of power were begun by Frank as far back as 1897. In connection with Caro he applied their modified Mond process for the treatment of coal to air-dried peat, and it is largely due to Caro's experimental work of recent years that the industrial problem in this latter field has been solved so successfully. The great difficulty attending all efforts to utilize peat hitherto has been the cost of drying the crude material and transporting it for any distance. Caro has devised a practical method of using peat when it contains 50 per cent, and even 60 per cent, of water. Peat of this grade is readily obtained at all seasons of the year by air-drying. He established the fact that in order to secure a maximum transformation of the nitrogen present into ammonia gasification must take place at a temperature above 250°C . In order to accomplish this he has departed widely from the ordinary type of generator used for coal.

THE GENERATOR.

The generator devised by him for special use with peat (German patent 238829) consists of an iron cylinder narrowed at the top and at the bottom. The middle section contains numerous perforations, and the lower part is practically a set of grate bars. Gases and

vapors escape from the top. The cylinder is entirely inclosed by an iron mantle. Provision is made for the continuous ignition of air-dried peat at the top of the generator. After the cylinder has been charged with peat, a mixture of air and steam, previously heated to over 400° , is admitted to the enveloping chamber. The current enters through the perforations into the central section of the generator, and through the grate at the bottom. The hydrolysis of the nitrogen takes place in the middle zone of the generator, while carbonized peat descends to the lower portion to undergo a restricted combustion at a more elevated temperature. As a result, the expulsion of the water from the damp peat and its gasification take place simultaneously. Nearly 80 per cent of the nitrogen present is transformed into ammonia, and excellent power gas is secured.

PRODUCTION AT THE MONT CENIS WORKS.

The composition of the power gas as secured at the Mont Cenis works is 16 per cent CO_2 , 16 per cent CO , 26 per cent H , 5 per cent CH_4 , and 37 per cent N . When the percentage of nitrogen in dry peat is 1 (the ordinary figure) the yield of ammonium sulphate per ton of dry peat is 40 kilos. With 2 per cent of nitrogen it reaches 85 kilos and with 3 per cent 130 kilos.

The gas has a thermal value of 1,250 to 1,350 calories. After deduction of what is needed for motive power, etc., the gas yielded by 1 ton of dry peat, in the damp form (containing 50 to 60 per cent of water), is capable of generating 650 to 750 horsepower hours in gas motor engines. When production is continuous the figure rises to 900 horsepower hours. If the percentage of nitrogen reaches 1.25 per cent (calculated as before, to perfectly dry peat), the value of the ammonium sulphate obtained covers the entire cost of extracting the peat and of gasification. If the percentage attains 2 per cent, as occurs in certain German bogs, the value of the sulphate covers also the transformation of the gas into electric power.

It is evident that such results open a wide vista for the effective utilization of peat deposits when there is a market available for electric power at no remote distance. Even in sections where there is at present no industrial demand for electric power, it may be easy to combine such an exploitation of extensive peat bogs with the production of air nitrates, cyanamide, or aluminum nitride by the processes already described.

RESULTS IN GERMANY.

The introduction of such an economical combination of the joint production of ammonium sulphate and electrical power from otherwise worthless peat bogs seems particularly easy in Germany. Under the direction of Frank and Caro, the first establishment for the purpose has been equipped and set in operation on the Dammer moorland, not far from Osnabruck. The equipment is capable of furnishing electric power equivalent to 4,000 horsepower. But one-half of the plant is actually under operation at the outset. The electric power obtained is supplied to the city of Osnabruck and to 30 rural communities. The local conditions are such that 1 hectare

(2.47 acres) of peat bog, with an average depth of 3 meters, furnishes 30,000 cubic meters of peat. Air-dried, this is equivalent to 6,000 metric tons of peat with 50 per cent of water. Transformed into electric power, this represents 2,000,000 horsepower hours. The output of ammonium sulphate would be 120 tons, worth over \$8,000. There is also a by-product of about 45 tons of tar. This tar contains 15 per cent of soft paraffin and 50 per cent of neutral oils, which can be used without special purification in Diesel motors.

The Osnabruck plant when in full activity will clear annually nearly 40 acres of peat bog and leave the land in suitable condition for the needs of agriculture. As the peat bogs of Germany comprise 7,200,000 acres and represent 5.2 per cent of the area of the Empire, the Frank and Caro process means a constant enlargement of the surface of land suitable for agriculture, while supplying cheap electric power in a country possessing but limited water power and doing much to solve the nitrogen question.

The Frank and Caro method is now in the hands of the Deutsche Mondgas- und Nebenprodukten Gesellschaft of Sodingen. This company furnishes designs and equipment for plants similar to the one erected near Osnabruck. A special company formed for the purpose of utilizing the peat bogs of the Province of Hanover supplied the requisite capital in the case.

ITALIAN AND BRITISH PLANTS.

A smaller plant of the same character has been established in Italy at Orentano, near Pisa, capable of supplying 400 electric horsepower. The results have been very satisfactory thus far. The plant has been erected by an English company, the Power Gas Corporation, which participated also in the preliminary experiments at Mont Cenis, in Germany. This company, in its experimental plants at Stockton and Wannington, has likewise contributed much of value to the final solution of the peat question, making use, however, of peat more highly dried than is necessary for the Frank-Caro process.

A method analogous to the Frank-Caro process has been devised in England by H. C. Woltereck (English patent 15285; 1909), and has been for a short time in operation at the great bogs of Carnlough in Ireland. A temperature of 450° C. is maintained, while air and steam pass over the peat briquets, and a portion of the gas evolved, after being freed from tar and ammonia, is mixed with this current of air and steam. The conditions are such that a certain amount of acetic acid is secured, along with a considerable quantity of paraffin, among the by-products. Calculated by dry peat, the yield is 1 to 1.5 per cent acetic acid, 3 to 8 per cent paraffin, and 5 per cent ammonium sulphate.

Jones & Saurez (German patent 220670) carry on the process much as does Woltereck, but allow a temperature of 500° C. These inventors, and also Woltereck, claim that they secure from peat more ammonia than corresponds to the nitrogen originally present, and that there is a fixation of atmospheric nitrogen. The possibility of any such fixation has been disproved by Caro in an exhaustive series of experiments.

In this connection it is to be noted that Caro, under favorable experimental conditions, has been able to secure in the form of ammonia more than 90 per cent of the nitrogen present in the peat. It is not improbable that the normal yield in plants erected for the industrial utilization of peat may gradually increase. At present it ranges between 70 per cent and 85 per cent.

OBJECTIONS TO FRANK-CARO METHOD.

There is some strong opposition in Germany to the extension of the Frank-Caro method on the part of those who hold that peat is most economically used by burning it under boilers and employing the steam thus generated to operate dynamos. A plant of this description has been erected for the Prussian Government by Siemens & Halske near the Aurich Wiesmoor peat bogs. Dr. Ramm, of the Prussian Agricultural Department, lately expressed his belief that more peat was required to produce a given amount of electric power by the Frank-Caro process than when steam is employed. He maintains also that on account of the irregular demand for electric power during the course of a day a plant can not be successfully operated without a certain dependence upon boiler power.

This whole problem of the most effective utilization of peat is still in its infancy and some time must elapse before all the factors are definitely settled. I find, however, that the leading technical chemists of Germany incline strongly to the conviction that the Frank-Caro process is the most economical solution thus far presented.

AMMONIA FROM SILT.

The finely divided silt carried along by rivers and deposited at various points, more especially at their outlets in lakes, or in the sea, contains frequently a high percentage of nitrogen. Such deposits are practically identical with the lowest layer in a deep peat bog. The silt of German rivers, when dried at 100° C., often has as much as 2 per cent of nitrogen. The richest deposits are at Ludwigshof, where the nitrogen ranges from 2.4 to 4.1 per cent. As early as 1899 a method was developed by Knublauch (German patents 115462, 137453, and 142505), and operated on an industrial scale for securing ammonium sulphate from the Ludwigshof silt. By simple distillation 40 per cent of the nitrogen was transferred into ammonia. The yield was increased by the addition of lime or alkalies as well as by the passage of steam. As the residual coke contained 70 per cent of ash it was found advantageous to distill mixtures of dried silt and coal refuse in order to obtain a suitable commercial coke as residue.

Caro has found by numerous experiments on German and English silt that the modified Mond process is admirably adapted to secure nearly all of the nitrogen present in the form of ammonia. A temperature ranging from 250° to 350° C. is found the most favorable for the reaction as compared with 250° for peat.

The possible applications in this field are naturally more limited than in the case of peat, and yet in nearly all countries there are deltas now forming, or formed in earlier ages, which are susceptible of exploitation.

AMMONIA FROM ORGANIC REFUSE.

Closely allied to the studies made on peat and silt as profitable sources of ammonia, are several other recent methods to rescue the nitrogen of organic refuse matter. The residues of the beet-root sugar manufacture, which are so rich in organic amines, are utilized now as sources of cyanides; but there are also several patented methods of securing the nitrogen in the form of ammonia. Mention may be made of the processes of Pataky (German patent 105638), of Matthiesen (German patents 88147 and 93397), of Sternburg (German patent 209114), and of Effront (German patent 209114). The last two employ mixtures of air and steam, and approximate the central idea of the Frank-Caro process.

Successful methods are in use in Paris, Amsterdam, and Stockholm for the manufacture of ammonia from fecal matter. The wash water in connection with the scouring of wool has also been used.

CONCLUSION.

In considering to what extent the new processes for utilizing atmospheric nitrogen are susceptible of introduction under American conditions, the following points are to be borne in mind:

The synthetic production of nitric acid from the atmosphere is a highly specialized process, dependent for the time being on exceptionally cheap sources of electricity. Many are laboring upon the problem of increasing the output per unit of electric power. Such experiments are most advantageously conducted in connection with the gigantic plants in Scandinavia.

The case is different with cyanamide. Here is a product that can be easily produced wherever calcium carbide is manufactured. Its value as a fertilizer becomes more manifest each year. The items of its cost are easily controlled. It is a material from which our stock of cyanides can be economically produced. At present we send abroad annually \$750,000 for various cyanides. It is susceptible of application on a large scale in gold mining. In 1910 imports of cyanamide reached \$40,000, so that evidently its use in agriculture is recognized. The establishment of cyanamide works at several points on American soil, where water power is relatively cheap, and earnest propaganda in connection with the employment of the new fertilizer in farming would constitute an important step in freeing our country from dependence upon foreign sources of combined nitrogen.

The same may be said to some extent, but with considerable reserve, in regard to aluminum nitride. The manufacture of the compound involves even less power than that of cyanamide, and the transformation of the combined nitrogen into the form of ammonia is less expensive than in the case of cyanamide. Granting the correctness of the claims made in favor of this latest nitrogen industry, the United States is certainly one of the countries specially favored for the establishment of the manufacture, as it possesses fairly extensive deposits of bauxite, the mineral serving for the fixation of nitrogen. There is much to warrant American enterprise in studying very closely the possibilities of this new industry. It promises to furnish ammonium compounds far more economically than any existing process and involves a simpler plant than that required for cyanamide or air nitrates. (The patent rights are held by the Société Générale des Nitrures, 12 Rue Roquepine, Paris.)

It will be noted that at present the methods for producing ammonia and ammonium compounds—more particularly the staple product, ammonium sulphate—seem to offer the larger field for the economic fixation of atmospheric nitrogen. The more complete utilization of the nitrogen present in coal, peat, etc., increases likewise the available supply of ammonia. In view of this trend in the

general movement, coupled with the prospective depletion of the stock of Chile saltpeter, it is eminently desirable that steps should promptly be taken to ascertain, as nearly as possible, under what conditions and to what extent ammonium sulphate can satisfactorily replace Chile saltpeter for the most important crops.

There is much diversity of opinion on this point, both in Europe and America. Some authorities assign to nitrogen in the form of ammonia a general value as fertilizer equal to that of nitrogen in the form of saltpeter. Others assign a lower value. Market quotations fluctuate, following naturally the laws of supply and demand, but frequently they show a higher valuation of ammonia nitrogen than of nitrogen in the form of nitrate. More definite data on this subject might aid naturally the plans of American investors in handling projects for establishing on American soil adequate plants for the domestic production of combined nitrogen.

In conclusion it can be regarded as beyond doubt that the present achievements of applied chemistry in this field render it possible for American industry and American agriculture to face the threatened exhaustion of the nitrate deposits of Chile and the demands attendant upon a rapidly growing population without any feeling of apprehension. The processes already perfected and described in detail show that there is no early danger of a nitrogen famine. The continual perfection of the processes and the appearance at frequent intervals of novel additional methods, as well as the popularization of the new forms of combined nitrogen, all point to a steady movement forward and to the assurance that combined nitrogen, as an industrial product, will be furnished on an increased scale without advance in cost above existing rates as fast as the demand is evident.

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DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 53

COTTON GOODS IN THE BALKAN STATES

By

RALPH M. ODELL

Commercial Agent of the Department of Commerce and Labor

**TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD**



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LETTER OF TRANSMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,

Washington, June 11, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1912, approved March 4, 1911, a report by Commercial Agent Ralph M. Odell, of this department, containing the result of his investigations of the trade in cotton goods in the Balkan States.

Respectfully,

BENJ. S. CABLE,
Acting Secretary.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, May 1, 1912.

SIR: I have the honor to submit herewith a report by Commercial Agent Ralph M. Odell on the cotton-goods trade of Roumania, Bulgaria, and Servia. Investigation shows that American cotton goods can be sold in each of these countries if proper effort is made and if American manufacturers are disposed to meet local requirements as regards terms of credit and quotations. The markets of these three Balkan States, with annual imports valued at approximately \$125,000,000, have apparently been neglected by American exporters, as our share of the import trade is less than 1 per cent. What business the United States now enjoys has been due not so much to the efforts of American manufacturers as to the initiative of the importers in these countries who are anxious to handle American products. The recent promulgation by Roumania of a law providing for the admission of American products under the conventional tariff removes one of the principal obstacles to an increase of American trade in that country. Mr. Odell has outlined the best methods for the successful exploitation of the field and has obtained numerous samples of the cotton goods in greatest demand.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

TO HON. CHARLES NAGEL,
Secretary of Commerce and Labor.

COTTON GOODS IN THE BALKAN STATES.

ROUMANIA.

GENERAL TRADE CONDITIONS.

Roumania has an area of 50,720 square miles and a population estimated in 1910 at 7,000,000. Its total foreign trade in 1909 amounted to \$160,837,846, of which the imports were valued at \$71,081,919 and the exports at \$89,755,927. The steady growth of Roumania's foreign trade is shown by the following table:

Years.	Imports.	Exports.	Years.	Imports.	Exports.
1890.....	\$49,280,000	\$42,251,000	1906.....	\$81,468,000	\$94,833,000
1895.....	51,828,000	47,858,000	1907.....	86,101,823	110,785,405
1899.....	70,019,000	63,260,000	1908.....	79,913,286	73,230,158
1895.....	58,783,000	51,154,000	1909.....	71,081,919	89,755,927
1900.....	41,878,000	54,040,000	1910.....	(*)	116,504,450
1905.....	65,145,000	88,220,000			

* Not available.

Exports are shipped chiefly through the ports of Braila and Galatz, near the mouth of the Danube, and Constantza, on the Black Sea. Imports also enter through these ports, but a considerable quantity comes overland from Austria-Hungary and Germany.

VALUE OF PRINCIPAL IMPORTS AND EXPORTS.

The value of the chief articles imported and exported in 1908 and 1909 is shown by the following table:

Articles.	1908	1909	Articles.	1908	1909
IMPORTS.			IMPORTS—continued.		
Metals, metallic articles, and mineral products.....	\$19,338,042	\$16,774,057	Live animals.....	\$763,863	\$759,387
Textiles of vegetable fibers.....	14,363,293	12,067,289	Cereals and derivatives.....	1,240,797	734,683
Machinery.....	7,250,017	6,195,567	Vegetable oils.....	1,133,549	700,727
Wool and woolen goods.....	7,301,345	6,074,095	Clocks and watches.....	521,144	514,545
Wearing apparel.....	4,083,192	3,467,552	Explosives.....	258,784	486,343
Hides, skins, and leather goods.....	2,998,044	2,618,108	Paints and varnishes.....	401,855	482,530
Silk and silk goods.....	2,419,667	2,367,082	Furs.....	525,286	474,681
Animal products.....	2,018,086	2,337,553	All other articles.....	2,081,863	1,847,525
Fruits and spices.....	2,141,385	2,144,518			
Wood and woodenware.....	1,943,983	1,884,342	Total.....	79,913,286	71,081,919
Vegetables, flowers, and seeds.....	1,530,072	1,588,890	EXPORTS.		
Chemicals, drugs, and medicines.....	1,474,535	1,516,905	Cereal products.....	54,512,174	69,014,463
Vehicles, automobiles, and tank cars.....	2,671,442	1,498,968	Petroleum products.....	7,448,763	6,999,829
Rubber, gutta-percha, and gums.....	604,614	1,308,121	Wood and lumber.....	5,110,251	5,683,013
Paper and paper products.....	1,080,121	906,145	Vegetable products other than cereals.....	2,267,844	4,036,092
Earthen and stone ware.....	1,043,413	896,468	Animal products.....	1,551,144	1,330,195
Glassware.....	894,894	645,832	Wool and woolsens.....	341,266	406,409
			All other articles.....	1,998,716	2,285,926
			Total.....	73,230,158	89,755,927

DISTRIBUTION OF FOREIGN TRADE.

The following table shows in round numbers the value of imports from and exports to foreign countries in 1908 and 1909:

Countries.	Imports.		Exports.	
	1908	1909	1908	1909
Austria-Hungary.....	\$16,329,000	\$16,557,000	\$5,016,000	\$22,201,000
Belgium.....	2,494,000	2,240,000	20,424,000	23,410,000
France.....	4,493,000	4,570,000	5,363,000	5,308,000
Germany.....	27,176,000	24,055,000	4,741,000	5,135,000
Italy.....	4,157,000	3,411,000	6,635,000	6,562,000
Netherlands.....	1,090,000	1,035,000	11,584,000	9,552,000
Russia.....	2,458,000	2,081,000	1,623,000	797,000
Switzerland.....	1,478,000	1,350,000	31,000	15,000
Turkey.....	2,758,000	2,240,000	3,734,000	4,144,000
United Kingdom.....	12,807,000	11,151,000	7,793,000	6,680,000
All other countries.....	2,673,000	2,392,000	6,386,000	5,943,000
Total.....	79,913,000	71,062,000	73,230,000	89,756,000

The trade with the United States does not appear in the Roumanian statistics, but American statistics show that in 1909 the United States exported goods to Roumania to the value of \$603,411. This includes only direct shipments, in addition to which American goods come into Roumania from Germany and Turkey and are credited to those countries. Exports from Roumania to the United States in 1909, as shown by consular invoices, were only \$2,549, but in 1910 they increased to \$113,285—chiefly tobacco and fusel oil. American exports to Roumania are mainly agricultural machinery and implements, cottonseed oil, shoes, typewriters, automobiles, and miscellaneous machinery and tools. At the request of the American chargé d'affaires in Bucharest the Roumanian Government has agreed hereafter to give separate statistics of the trade with the United States.

From the foregoing table Belgium and the Netherlands would appear to be among Roumania's best customers. As a matter of fact, many of the exports to those countries are finally consumed by Germany and England. Splendid shipping service is maintained between Braila and Antwerp and Rotterdam, and in the grain season large cargoes of wheat, corn, and other cereals are shipped over this route.

Roumania is essentially an agricultural country, and cereals form by far the largest part of the export trade. There are also rich coal and oil deposits in the country, as well as salt mines and extensive forests. But the wealth of the country is derived chiefly from the products of the fields, and the buying power of the people—more than 80 per cent of whom live in the rural districts—depends upon the crops. In 1910 the crops were the largest in the history of the country, and preliminary statistics indicate that the exports that year exceeded all previous records. Import figures for 1910 are not yet available, but they also will doubtless show a great increase.

OBSTACLES TO AMERICAN TRADE—TARIFF ON COTTON GOODS.

In the steadily expanding trade of Roumania the United States has heretofore had a very small share. There have been two chief ob-

stacles to the development of our trade with that country. The principal exports of Roumania—cereals, oil, and timber—are articles which the United States produces in sufficient quantities for home consumption, whereas European countries are buyers of these products and large shipments are made each year to Germany, Austria-Hungary, Italy, France, England, and Turkey. It is natural that Roumania should endeavor to promote trade with these countries rather than with a country which buys an almost insignificant amount of her products.

A more serious handicap to the increase of American trade has been the tariff, which imposed a higher duty, in the case of many articles, on goods from the United States than on imports from European countries. England, Germany, Austria-Hungary, France, Spain, Italy, Turkey, and Russia have had treaties with Roumania by terms of which goods from these countries have enjoyed the conventional rates, while American products were subject to the general rates. This obstacle has been removed by the law promulgated in May, 1912, providing for the admission of American products under the conventional tariff. The following table shows the general and conventional rates on cotton goods:

Articles.	Rate of duty per 100 kilos.		Rate of duty per 100 pounds.	
	General tariff.	Conventional tariff.	General tariff.	Conventional tariff.
Yarn, single:	<i>Lei.</i>	<i>Lei.</i>		
Unbleached.....	3.00		\$0.263	
Bleached.....	5.00		.438	
Dyed or printed.....	12.00		1.055	
Mercerized.....	14.00		1.230	
Yarn, ply:				
Single twist.....	(¹)		(²)	
Multiple twist.....	(³)		(⁴)	
Sewing thread:				
Undyed.....	75.00	50.00	6.57	\$4.38
Dyed or mercerized.....	100.00	60.00	8.80	5.25
Yarn, twisted, on rollers ready for loom.....	(⁵)	(²)	(⁶)	(⁷)
Fabrics, unbleached and undyed:				
Weighting above 180 grams per square meter (5.31 ounces per square yard) and having in the warp and weft per square centimeter (0.155 square inch)—				
Up to 35 threads.....	75.00	55.00	6.57	4.82
From 36 to 55 threads.....	100.00	65.00	8.80	5.69
More than 55 threads.....	125.00	100.00	10.99	8.80
Weighting 100 to 180 grams per square meter (2.95 to 5.31 ounces per square yard) and having in the warp and weft per square centimeter—				
Up to 40 threads.....	90.00	60.00	7.88	5.25
From 41 to 70 threads.....	105.00	75.00	9.24	6.57
More than 70 threads.....	175.00	120.00	15.37	10.55
Weighting 70 to 100 grams per square meter (2.06 to 2.95 ounces per square yard) and having in the warp and weft per square centimeter—				
Up to 50 threads.....	100.00	70.00	8.80	6.13
From 51 to 80 threads.....	130.00	90.00	11.43	7.88
More than 80 threads.....	200.00	130.00	17.50	11.43
Weighting 70 grams or less per square meter (2.06 ounces or less per square yard) and having in the warp and weft per square centimeter—				
Up to 50 threads.....	125.00	125.00	10.99	10.99
From 51 to 80 threads.....	150.00	150.00	13.18	13.18
More than 80 threads.....	250.00	250.00	21.83	21.88

¹ Duty on component yarns plus 6 lei per 100 kilos.

² Duty on component yarns plus 12 lei per 100 kilos.

³ Duty on component yarns plus \$0.525 per 100 pounds.

⁴ Duty on component yarns plus \$1.055 per 100 pounds.

⁵ Duty on component yarns plus 0.50 lei per 100 kilos.

⁶ Duty on component yarns plus \$0.044 per 100 pounds.

Articles	Rate of duty per 100 kilos.		Rate of duty per 100 pounds.	
	General tariff.	Conventional tariff.	General tariff.	Conventional tariff.
Fabrics, bleached.....	Lci. (1)	Lci. (1)	(1)	(1)
Fabrics, dyed:				
In one color.....	(2)	(1)	(2)	(1)
In two or more colors.....	(3)	(1)	(3)	(1)
Fabrics, printed.....	(3)	(1)	(3)	(1)
Book muslin and canvas.....	100.00	80.00	\$8.80	\$7.00
Plushes and velvets:				
Of one color.....	150.00	120.00	13.18	10.55
Dyed or printed in more than one color.....	200.00	150.00	17.50	13.18
Flannels, drawers and all other knitted articles not specially mentioned.....	250.00	200.00	21.88	17.50
Knitted hosiery.....	280.00	215.00	24.50	18.82
Knitted gloves.....	350.00	280.00	30.68	24.80

¹ Duty on unbleached fabrics plus 20 per cent.

² Duty on unbleached fabrics plus 30 per cent.

³ Duty on unbleached fabrics plus 40 per cent.

SALES OF AMERICAN SHOES.

In two articles on which there has been no difference in the rates of duty, namely, agricultural machinery and shoes, American manufacturers have been able to establish a good trade. In nearly a dozen stores in Bucharest I observed various brands of American shoes. American goods are not well known in Roumania, but there is a desire to know more about them, and, fortunately, a high opinion of the quality of things American. At many shops American flags are displayed in the windows or are painted on the outside, and "articles Americains" is used as a sign to attract buyers and to emphasize the excellent quality of the merchandise on sale. Usually the only American goods in these stores are shoes and rubber goods. Sometimes, unfortunately, only imitations of American goods are sold, often with an English name or mark in order to make the buyer think he is getting the real article.

Conversations with dealers in American shoes developed the fact that there is a steadily growing demand for both American shoes and rubbers, and there is every reason to believe that trade in many other lines could be developed if proper methods of introducing the goods were employed. The shoe trade could be considerably increased if an enterprising American or Roumanian firm were to establish in Bucharest a large store, carrying a full stock of styles and sizes. The trade is now divided among 10 or 12 small dealers, each of whom has only a limited stock on hand. Frequently it happens that a prospective customer, attracted by the quality and shape of the American shoe, enters a shop only to find that he can not get the size desired, and he goes away feeling that the shoes are in some way inferior because he can not get what he wants. If the business were conducted on a more extensive scale, enabling the dealer to carry a larger stock, much better results could be obtained.

Another means of promoting trade in shoes, and this applies to other lines as well, was brought out in a conversation with a Bucharest merchant. This dealer stated that during the several years he had been handling American shoes he had never received a

call from a representative of the house. While a certain amount of business can be done by long-distance correspondence, the American manufacturer can secure more satisfactory results if at least once a year a representative of the firm calls on the Roumanian merchant, looks over his stock, and offers suggestions for increasing sales. Personal contact would undoubtedly stimulate the growth of our trade; the lack of it distinguishes American trade in Roumania from that of other countries. At least twice a year German, Austrian, English, and Italian manufacturers send representatives to confer with their agents and to cooperate with them in effecting sales.

AGRICULTURAL MACHINERY.

The Roumanian market is like that of many other countries in which there is a steady demand for manufactured articles. Being essentially an agricultural country, with a low tariff, there is a splendid opportunity for the sale of American agricultural machinery. If American firms place their products in the hands of good agents and cooperate with them by a campaign of publicity a splendid business can be done. It is estimated that 37 per cent of the agricultural machinery now used in Roumania comes from the United States; but we could secure a much larger share of this trade if the proper efforts were made.

The present duty on agricultural machinery and seed drills, winnowers, plows, harrows, and cultivators is 2 lei per 100 kilos (\$0.175 per 100 pounds), and on implements such as hoes, scythes, sickles, and forks, 7 lei per 100 kilos (\$0.613 per 100 pounds). There was in this case no difference between the general and conventional tariffs, and American machines entered on the same basis as those from other countries. Improved methods of cultivation in Roumania are widening the field for the sale of agricultural machinery and implements, and American manufacturers would do well to make a serious effort to secure a larger share of the trade by sending out representatives to demonstrate the merits of their machines.

COTTONSEED OIL—OLIVE OIL.

Cottonseed oil ranks next to agricultural machinery among the articles the United States sells to Roumania, and the demand is rapidly increasing. In 1908 the total imports amounted to \$206,412 and in 1909 to \$386,975. Of the latter approximately one-fourth was credited to the United Kingdom, Austria-Hungary, Italy, Germany, and Turkey, and three-fourths to "other countries." As cottonseed oil is not produced to any considerable extent in the countries named, and as the amount given under "other countries" refers chiefly to the United States, it is safe to assume that all of this oil was originally shipped from America. The market in Roumania for cottonseed oil has been investigated and treated fully by a commercial agent of the Department of Commerce and Labor. The tariff discrimination against cottonseed oil which existed at the time of his visit still obtains, but the demand is steadily growing because of the many new uses to which the oil can be put. This market deserves the serious attention of oil manufacturers.

The imports of olive oil, the chief competing article, amounted to only \$206,861 in 1909 as compared with \$877,781 in 1908. The duty on olive oil is 5 lei per 100 kilos (\$0.438 per 100 pounds) if in casks and 12 lei per 100 kilos (\$1.055 per 100 pounds) if in bottles or other receptacles. These are the conventional rates, and the general tariff is 10 and 18 lei per 100 kilos, respectively. The duty on cottonseed oil under both rates is 30 lei per 100 kilos (\$2.63 per 100 pounds).

TYPEWRITERS, AUTOMOBILES, TOOLS, ETC.

There are only two agencies for American typewriters in Roumania, and the trade in this line appears to have been neglected. Latin letters are used in the Roumanian language, and the obstacle encountered in Bulgaria and Servia, where Slavish letters are used, does not exist here. One American automobile is sold on this market, and the business has been very satisfactory, more than 40 machines having been sold in less than a year. A substantial, cheap car is desired, and if capable agents are selected and supported by the manufacturers a good trade can be built up. The trade in shoes has already been mentioned. The predilection of the natives for the American-style shoes and the good reputation which they enjoy should be used to advantage in increasing our trade. There is also a good demand for rubbers and goloshes, which are almost universally worn by the better classes during the winter months, and the American product is very much in favor.

The opportunities for the introduction and sale of other products of American manufacture in Roumania are numerous and varied. The large forest area of the country—more than 900,000 acres—creates a demand for sawmill machinery. The rich deposits of coal and of oil suitable for fuel make the country a good market for the sale of oil and gas engines for use in the industries. There are numerous flour mills, sugar factories, and chemical works, and a few cotton, woolen, linen, and silk mills; although manufacturing is not conducted on a large scale, the Government is endeavoring to promote the country's industrial development by granting liberal concessions, and American manufacturers of engines, pumps, machinery, and tools can obtain a share of the trade this industrial awakening will create. American hardware is not enjoying the sale it deserves.

BEST METHOD OF ENTERING MARKET.

American trade can be obtained here in proportion to the real desire of manufacturers to enter the field and their willingness to adapt their methods to existing conditions. The New York manufacturer of machinery, tools, or hardware does not introduce his goods into Texas or Illinois by correspondence and catalogues, but through a representative from the home office. It is just as essential that he should employ the same methods in placing his products in Roumania and the markets of the Near East.

I have found an earnest desire among merchants and jobbers to represent certain American products. In appointing agents, however, the same care and judgment should be exercised as at home. In the World Trade Directory, issued by the Bureau of Manufactures, there is a list of dealers in the principal lines of goods in Bucharest. A supplementary list is transmitted with this report [and may be

obtained from the Bureau of Manufactures]. Business relations, however, can be best established through a visit to the country by a personal representative of the manufacturer. Bucharest can be reached from Berlin in 34 hours, from Vienna in 26 hours, and from Constantinople in 20 hours.

Whatever the merit of an article, its value or good qualities must be demonstrated by some person who is familiar with it and who is authorized to select an agent after going over the field thoroughly. Through the local agent the particular tastes and requirements of the trade can be ascertained and met, and difficulties can be overcome through mutual cooperation. But having selected an agent, he should not be left to develop the business alone; he should be visited at least once a year in order to secure the most satisfactory returns.

Good results can not be obtained by sending out catalogues or letters in an unfamiliar language, with prices quoted in a currency the value of which is unknown. English is not generally understood, and the merchants are too busy to hunt up friends to translate letters or catalogues for them or to search through books to ascertain the value of American money. This is sometimes done in the case of an article that possesses some peculiar merit, but, generally speaking, the business is secured by some German or English house that has a representative on the ground with all information and details regarding prices, and usually with a full line of samples of the articles offered. French or German is spoken by a large majority of the better classes and by practically all the merchants and business men; correspondence and catalogues should be in one of these languages, preferably French.

CURRENCY, WEIGHTS, AND MEASURES—CREDITS.

The monetary unit of Roumania is the leu, which is of the same value as the franc (\$0.193), and quotations should be in francs. The metric system is in general use, although Turkish weights and measures are employed to a limited extent. In the matter of credits, business can be done on a safe basis if proper care is exercised. Many merchants are able and willing to pay cash against shipping documents, if it is demanded; but this method of settlement is not the rule, and, other things being equal, the German, English, or Italian manufacturers will secure the preference because they extend liberal terms. Business is not conducted on a large scale, and many merchants of high commercial standing operate on small capital. As they must extend credit to their customers it is sometimes hard for them to meet the insistent demands of American dealers for cash payments.

Conditions in this respect can best be appreciated and met by a personal visit to the field, and careful inquiry as to the reliability of agents or merchants. So long as American manufacturers are unwilling to grant the same credits as competing nations the volume of American trade must necessarily suffer and be limited to those who are willing to tie up their funds in bankers' credits for the privilege of handling American goods. There are many houses here that buy on credit and from whom a debt is a perfectly sound asset. It is to be regretted that orders from such firms should be lost because we refuse to offer the same credit terms as our competitors.

COTTON GOODS TRADE.

Careful investigation and inquiries among importers and dealers revealed the fact that American cloth and cotton goods are unknown on this market. Textiles made of vegetable fibers rank second in importance among the imports of the country; and while this classification includes cotton, flax, hemp, and jute products, cotton manufactures constitute by far the greater part of the total.

The following table shows the value of the yarn, cloth, and other manufactures of cotton imported by Roumania in 1908 and 1909:

Articles.	1908	1909	Articles.	1908	1909
Yarn:			Fabrics—Continued.		
Single—			Dyed in one color.....	\$780,430	\$671,477
Unbleached.....	\$2,517,164	\$2,362,581	Dyed in several colors		
Bleached.....	589,960	437,729	or printed.....	4,040,705	3,568,832
Dyed or mercer-			Table covers, curtains,		
ized.....	264,473	306,294	draperies.....	1,391,434	1,228,283
Twisted—			Laces and embroideries..	409,910	358,076
Unbleached.....	67,290	27,401	Knit goods.....	345,070	246,940
Bleached.....	21,272	19,944	Made-up articles of plain		
Dyed or mercer-			cotton or trimmed with		
ized.....	136,700	132,858	silk, lace, or fur.....	186,592	175,764
On beams or spools			Cotton velvets and plush..	183,450	147,953
ready for the loom—			Oileloth.....	118,521	115,329
Unbleached.....	749,695	451,558	Tulle and curtain lace....	114,419	94,464
Bleached.....	34,298	34,817	Ribbons and braids.....	57,648	58,530
Dyed or mercer-			Tarred cloth and linoleum	70,178	37,588
ized.....	266,100	123,020	Passamenterie.....	35,170	30,098
Sewing thread.....	440,829	420,318	Book muslin and canvas..	44,314	29,307
Total.....	5,093,841	4,316,520	Lamp wicks.....	12,828	13,138
Fabrics:			Trimmings and buttons..	1,141	1,492
Unbleached.....	195,148	164,900	Total.....	9,022,894	8,062,851
Bleached.....	1,035,936	910,148	Grand total.....	14,116,735	12,369,371

The total value of the imports in 1909 was nearly \$2,000,000 less than in the preceding year. Crops, on which the foreign trade of the country so largely depends, were very poor in 1908, and this accounts in a large measure for the heavy decline in imports during the year following, at which time the effects of the small yield were most keenly felt. Crops were good in 1909, and in 1910 the yield exceeded all previous records. Statistics of imports during 1910 are not now available, but they will undoubtedly show a large increase.

COTTON MANUFACTURING.

Another reason for the decreased imports of cotton goods is the development of the local cotton industry, which has only begun to assume a degree of importance during the last few years. There are now in Roumania 8 cotton-weaving mills, which contain 3,000 looms and employ about 2,000 operatives. The most important of these is the Fabrica Română de Bumbăcărie Colentina, at Bucharest. In the weave shed of this mill, which is of modern saw-tooth roof construction, 640 looms are operated. Four hundred workpeople are employed, at an average daily wage of 2.50 francs (\$0.483). The mill is managed by an Englishman, and all the overseers are Englishmen. Power is developed by a Diesel oil engine, at a cost of about \$10 per horsepower per year of approximately 300 working days of 10 hours each. The oil used is obtained from native fields and costs, at present, 50 francs (\$9.65) per metric ton (2,204 pounds). In

connection with its weave shed this mill operates a bleachery—the only one in the country—and the production of 100,000 meters (109,361 yards) per week consists entirely of “chiffon,” or bleached goods, of many different qualities. The better grades are 72 by 72 picks with 30s warp and 30s filling, while the lower qualities are 56 by 56 and 64 by 64 picks with 20s to 24s yarn. The cloth is put up book fold, 30 meters to the piece, and is carefully and neatly wrapped in black glazed paper.

There are four other mills in Bucharest, two with 400 looms each, one with 300 looms, and one with 88 looms; there are also three others in different parts of the country, all of which are branches of English firms or are controlled by English mills. The product of the native mills consists of gray goods and coarse colored goods, such as stripes, plaids, cottonades, and cheap gingham. Spinning is not carried on and the mills buy their yarn chiefly from England. It is shipped on cops and is spooled, warped, and slashed at the mill.

To encourage industries in Roumania, the Government a number of years ago enacted a law which granted for a term of 15 years the following privileges and concessions to those who established factories: (1) Free land up to 5 hectares (12.36 acres), (2) exemption from all taxes, (3) exemption from import duties on machinery and on raw materials not produced in the country, (4) reduction in freight rates of 35 per cent on all raw materials and 45 per cent on manufactured goods.

The cotton industry has been further assisted by the fact that the Government requires a large amount of cloth each year for shirts for the soldiers, and under the present law one-half of the contract must be given to the mills and one-half to the peasants who weave cloth on hand looms. While the total annual production of the cotton mills is valued at only about \$1,000,000, practically all the gray goods and the cheaper qualities of bleached and colored goods which were formerly imported are now furnished by the native mills.

SOURCE OF IMPORTS.

The share of the various nations in the cotton-goods trade in 1909 is shown by the following table; the amounts are given in pounds, as the statistics do not show the value of the goods imported from each country:

Articles.	United Kingdom.	Austria-Hungary.	Italy.	Germany.	France.	Other countries.	Total.
Yarn:	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Single—							
Unbleached	8,088,628	1,369,194	2,232,001	1,034,002	65,000	35,446	12,824,271
Bleached	56,364	1,060,154	808,817	62,553	2,937	5,056	1,995,891
Dyed or mercerized.....	74,813	624,657	87,652	434,914	207	24,684	1,246,927
Twisted—							
Unbleached	52,479	8,615	41,753	7,372	.....	4,004	114,223
Bleached	13,798	11,790	19,382	17,624	255	8,136	70,985
Dyed or mercerized.....	11,136	177,978	105,545	81,814	687	48,651	425,811
On beams or spools ready for the loom—							
Unbleached	1,435,348	199,936	238,366	170,529	2,563	12,175	2,058,917
Bleached	52,912	39,602	27,502	26,572	310	85	146,993
Dyed or mercerized.....	21,688	94,774	25,280	336,195	62	5,422	483,419
Sewing thread	682,609	323,466	17,507	210,823	12,615	18,645	1,265,065
Total	10,489,775	3,910,166	3,603,805	2,382,396	84,636	162,314	20,633,092

Articles.	United Kingdom.	Austria-Hungary.	Italy.	Germany.	France.	Other countries.	Total.
Fabrics:	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Unbleached.....	433,310	42,235	32,065	50,725	1,540	53,350	613,225
Bleached.....	1,374,232	317,775	391,232	266,937	51,410	231,460	2,633,046
Dyed or printed.....	3,704,523	2,251,623	2,476,828	2,386,388	153,839	704,381	11,677,582
Cotton velvets and plush.....	86,500	21,912	684	69,914	19,078	6,989	205,167
Tulle and laces for curtains.....	64,808	17,026	5,086	21,912	6,288	5,953	121,073
Laces and embroideries.....	72,626	11,425	2,761	41,120	5,507	24,640	158,079
Table covers, curtains, and draperies.....	91,843	266,783	57,057	184,813	28,512	176,544	805,532
Tarred cloth and linoleum.....	363,390	147,653	22,187	131,256	5,113	9,068	678,667
Oilcloth.....	167,962	218,141	1,980	41,538	6,750	4,140	440,451
Knit goods.....	959	34,683	3,450	269,020	17,864	4,989	330,955
Made-up articles of cotton or trimmed with silk, lace, or fur.....	2,076	85,147	937	23,230	16,262	4,670	132,322
All other manufactures.....	3,764	88,900	66,729	129,422	19,359	5,857	313,061
Total.....	6,366,073	3,503,303	3,059,946	3,616,275	331,552	1,232,041	18,109,190
Grand total.....	16,855,848	7,413,469	6,663,751	5,998,671	416,188	1,394,355	38,742,282

YARN TRADE—HAND-LOOM WEAVING—PEASANTS' COSTUMES.

The imports of yarn, exclusive of sewing thread, exceeded those of cloth. Part of this yarn was used by the weaving mills, but the greater portion was sold to peasants for use on hand looms. Practically every home in the country districts is provided with a hand loom, on which all the coarse heavy goods for clothing are woven. In proportion to population the extent of hand-loom weaving is perhaps greater in Roumania than in any other country in the world, with the possible exception of India. In the weaving of silk goods a very high degree of excellence has been attained by the peasants, and their products are very much sought after by the upper classes. This is due partly to the patronage of the present Queen of Roumania and her efforts to encourage the native industry.

The costume of the men in the rural districts usually consists of a long coarse cotton blouse, drawn in at the waist by a cord or belt, and trousers of the same material. The women generally wear a coarse, loose-fitting jacket or bodice, with a skirt of some dark-colored material and a handkerchief or head shawl over the head. In winter sheepskin is usually worn over the upper part of the body. Hosiery is not used by the poorer classes, the feet being wrapped with a narrow strip of cloth, or bandage, usually of the same material as the trousers, and extending up the leg. Instead of shoes, homemade sandals, usually of hemp, are worn. This is the everyday costume of the peasants. The gala or holiday dresses are rather handsome, each district in the country having its own peculiar costume. They are usually made of a combination of cotton and silk or wool and silk, and the mantle or shawl, which is wrapped gracefully around the lower part of the body, is often richly ornamented in bright and showy colors and sometimes with gold or silver threads. The entire costume is made by the peasant in the home, from imported yarn in the case of cotton, and from raw silk obtained in the country.

The largest item in the yarn imports is single unbleached yarn, most of which is 12s to 30s, put up in skeins and packed in 10-pound packages. More than half of the yarn imported in 1909 came from England; in fact, Roumania is one of England's best customers. British statistics show that, in quantity taken, Roumania in 1911

ranked fourth among the countries to which yarn was exported, coming after Germany, the Netherlands, and India.

CLOTH TRADE—GOODS FURNISHED BY VARIOUS COUNTRIES.

In cotton manufactures England is far in the lead, nearly one-third of the cloth and miscellaneous goods being purchased from that country. Austria-Hungary, Italy, Germany, France, and Switzerland are the other countries sharing largely in the trade. Of the amount credited to "other countries," Switzerland furnished 363,584 pounds, of which only 27,200 pounds was yarn. The principal manufactures furnished by Switzerland were bleached fabrics, 79,292 pounds; dyed or printed fabrics, 93,696 pounds; table covers, curtains, and draperies, 124,650 pounds. The remainder credited to other countries includes imports from Belgium, Netherlands, Turkey, Spain, and Russia, in the order named.

Italy's trade in Roumania has nearly doubled from 1900 to 1909. Formerly one of the least important, Italy is to-day one of the chief factors in the cotton-goods trade. This business has been secured by the same methods that the Italian cotton manufacturers have used in developing markets in Turkey, Argentina, and elsewhere. Representatives were sent out to study the field, ascertain what kinds of goods were in demand, and select agents. The manufacturers then proceeded to cater to the tastes of the people and to furnish the goods at a low price by the use of cheap cottons in the mixings and by weaving split goods. Examination of the various goods sold on this market revealed that practically all the split goods were of Italian manufacture. These items comprised more than 80 per cent of its total shipments of cloth to Roumania.

As a rule, the better grades of velvets come from England and France and the cheaper grades from Germany and Austria-Hungary. Sateens and linings are furnished by England and Italy and these countries are also the chief suppliers of duck in gray, blue, and brown, and in widths of 60, 70, and 80 centimeters (23.6, 27.6, and 31.5 inches). Switzerland leads in the embroidery trade. The better grades of lace come mostly from Nottingham, and the cheaper qualities from Germany.

Nankeen is a very popular cloth in Roumania. It is woven with white warp and colored filling and is somewhat similar to a stiff-finished chambray. In finish it differs from the nankeen used so widely in China, which usually has a soft finish. The colors in greatest demand are pink, red, and yellow or chamois. England, Germany, and Austria-Hungary share in the trade in this line, but recently it has been made in the native mills. A sample of the latter is forwarded with this report. It is 56 by 56 picks, 30/31 inches wide, and weighs 3.25 yards per pound. The goods are put up in book fold in lengths of 30 to 35 meters, and the present wholesale price is 67 to 70 bani per meter (11.81 to 12.34 cents per yard).

CLASS OF GOODS IN DEMAND.

The cloths in greatest demand in Roumania are prints, gingham, stripes, and printed flannelet and barchent, the last named being napped on one side. The better qualities of all these goods are fur-

nished by England, Germany, and Austria-Hungary, while the cheaper grades come from Italy and from the native mills. No print goods are made in Roumania. Lightweight prints and gingham are sold in summer, while flannelet, barchent, and imitation woolen goods are in demand during the winter months. Samples of all the principal qualities of these goods with present wholesale prices are forwarded with this report, and they merit examination by American manufacturers.

A popular English print, or calico, is 27 inches wide, weighs 7 yards per pound, and sells wholesale at 44 to 46 bani per meter (7.75 to 8.11 cents per yard). A print of Austrian make with a soft finish and made of finer yarns is 30/31 inches wide, 5.85 yards per pound, and sells at 65 to 68 bani per meter (11.46 to 11.99 cents per yard), while another from the same country is 27 inches wide, 7.5 yards per pound, and sells at 49 to 52 bani per meter (8.63 to 9.17 cents per yard). The two Austrian prints are sold under trade names that have been used for many years and are extremely popular. The sample of so-called "Florida," which very much resembles the cheaper grades of American madras, is woven in the native mills. It is 26/27 inches wide, weighs 4.75 yards per pound, and sells at 46 to 48 bani per meter (8.11 to 8.46 cents per yard).

In barchent Italy predominates, and a popular style is printed red with small white polka dots. It is a three-leaf twill weave 21/22 inches wide (woven double and split), weighs 6.25 yards per pound, and sells at 44 to 46 bani per meter (7.75 to 8.11 cents per yard). Another quality, printed in dark colors to resemble wool, is 27/28 inches wide, weighs 5 yards per pound, and the present price is 57 to 60 bani per meter (10.05 to 10.58 cents per yard). A popular Austrian flannelet, napped on one side, is made with colored yarn in a black and red check pattern with a fancy stripe. It is 26/27 inches wide, weighs 3 yards per pound, and sells at 86 to 91 bani per meter (15.17 to 16.05 cents per yard). A cottonade (called here "materia") from Switzerland is 18/19 inches wide, weighs 7.75 yards per pound, and is sold at 43 to 45 bani per meter (7.58 to 7.93 cents per yard). A piqué (napped on one side) from Austria is 27 inches wide, weighs 3.7 yards per pound, and the present price is 85 to 90 bani per meter (14.99 to 15.87 cents per yard).

The foregoing comprise the principal prints and colored goods sold on this market. In the samples which are forwarded several patterns of each style are shown. Red and blue are the most popular colors.

FABRICS MADE IN ROUMANIAN MILLS.

In gray and bleached sheetings and shirtings, croydons, madapol-lam, mexicans, long cloth, and chiffon (bleached shirting), all of which are widely sold, the native mills have practically driven out foreign goods, except in the finer grades, and imports are limited to the finer qualities, which come chiefly from England. Three grades of the latter, showing the most popular styles, are forwarded. The first is a madapollam 40/41 inches wide, 56 by 40 picks, weighs 3.7 yards per pound, and sells at 15.75 to 16.50 lei (\$3.04 to \$3.18) per 40-yard piece. The cloth is rather heavily filled with starch and is used in making flour bags. A somewhat better grade is 29/30 inches wide, 64 by 64 picks, weighs 7 yards per pound, and commands a

price of 13.75 to 14.25 lei (\$2.65 to \$2.75) per 40-yard piece, or 6.63 to 6.87 cents per yard. A croydon from England is 38/39 inches wide, 52 by 60 picks, weighs 3.75 yards per pound, and sells for 14 to 14.75 lei per piece of 22 meters (10.21 to 11.81 cents per yard).

Several samples of croydons, chiffons, and long cloth of native manufacture are furnished. The so-called chiffon is simply a bleached shirting, usually 31/32 inches wide and put up 30 meters (32.8 yards) to the piece. Long cloth, as known here, is bleached and unbleached sheeting 30 to 40 inches wide and put up in lengths of 33 meters (36 yards). While many of the gray and bleached goods have colored head ends woven in the cloth there is no strong demand for them and goods are not usually sold by headings or brands. In general, mexicans and long cloth are 33 meters to the piece; chiffon is 30 meters, croydon 22 meters, and madapollam (from abroad) 40 yards to the piece. Colored goods and prints are from 35 to 50 meters (38.28 to 54.68 yards) to the piece and come 40 to 50 pieces to the case, although there are no special requirements as to packing and generally a wide assortment of patterns in an individual case is not demanded except on an initial order. The latter statement refers only to the wholesale dealers, by whom most of the goods are imported, and not to retail houses, which sometimes import direct one or two cases of widely assorted goods.

As a rule the leading importers keep an open stock and pack goods for shipment to retail dealers in any manner desired by the customer. Gray and bleached goods should be put up narrow fold or book fold, in meter folds; for colored goods the book fold is absolutely necessary.

OPPORTUNITY TO INTRODUCE AMERICAN GOODS.

While the native mills supply the home demand for gray and bleached goods and, to a large extent, for cheap colored goods, foreign manufacturers are depended on for the better grades of these goods and for all prints, flannelets, piqués, percales, medium and fine ginghams, and velvets. The description and prices of the principal goods in demand which have been given above are sufficient to demonstrate the possibility of American manufacturers securing a share of this trade. The fact that American goods are unknown here would be no obstacle if they were properly brought to the attention of dealers and importers, and the desire of the people for things American makes the present an opportune time for the introduction of American cotton goods.

The best method of entering the market is that employed by the countries which now have the trade. The cotton manufacturers of England, Germany, Austria-Hungary, and Italy are represented in Bucharest by their own agents. Twice each year, in the spring and the fall, salesmen from the home office visit Bucharest, bringing with them a full line of samples, and they are prepared to quote prices for at least six months in advance. These salesmen, accompanied by the local agent, call on the various dealers, make inquiries as to any new styles or patterns in demand, and note any complaints that may have arisen. In short, everything possible is done to cooperate with and support the local agent, to keep in touch with the trade, and to increase business. Prices are usually quoted f. o. b.

Manchester, Vienna, or Berlin, and the customer pays all freight charges, duties, and other expenses. The terms are usually six months, and American manufacturers should at least endeavor to extend credit to cover the period required for transportation and delivery of the goods. The agents whose names are forwarded with this report [and which may be obtained from the Bureau of Manufactures] are reputed to be men of business integrity, and undoubtedly satisfactory credit arrangements can be made with them.

Roumania is a country that is developing rapidly through exploitation of its rich agricultural resources. At present the peasants' hand looms supply a considerable part of the cotton goods consumed, but the development of the country will doubtless cause a decline in this industry; and as the purchasing power of the people increases so will the demand for cotton goods. American cotton manufacturers should lose no time in securing a foothold in the market. Representatives with authority to appoint agents and with a full line of samples neatly and attractively prepared should visit the country without delay. The samples of American colored goods and prints that I exhibited to the trade impressed the dealers very favorably, and the prices are no higher than those quoted by other countries, after making due allowance for the higher freight rate. We should not neglect this market. The growing sentiment for American goods seems to favor us, and if a serious and conscientious effort is made along the lines indicated, good results will certainly follow. It will not be a wise policy simply to send samples and quote prices; the man on the ground usually gets the trade, and the market deserves special attention.

KNIT GOODS AND SPECIALTIES.

What has been said in regard to cotton goods applies equally to knit goods and specialties. Careful inquiry and investigation disclosed the fact that seamless hosiery is almost unknown here. The cheaper grades of knit goods are supplied by native mills, but the better qualities of cotton hosiery selling at 40 to 50 cents per pair are imported, chiefly from Germany. A good business could be done in seamless hosiery with a lisle finish, selling at 50 cents to \$1 per pair, because there is nothing on the market to be compared with it as regards quality and appearance. The person who desires something a little better than the ordinary cotton hose must be content with silk goods, for which he pays 12 to 15 lei (\$2.30 to \$2.90) and sometimes 20 lei (\$3.85) per pair.

There is a market for other lines of men's furnishing goods and haberdashery, and the fact that they are of American manufacture would at present secure a good trade for them. Several firms in Bucharest would be glad to put in a line of such goods, but they would first like to see samples, displayed by a representative of the firm. The possibilities of extending American trade in Roumania despite the disadvantages of distance are undoubtedly very favorable, and American manufacturers would do well to undertake an active campaign.

TRANSPORTATION AND FREIGHT RATES.

There is no direct steamship service to Roumania. Shipments may be made via Liverpool, Bremen, Hamburg, Rotterdam, Ant-

werp, or Constantinople, with transshipment at any of these ports. The time of passage is about 60 days by the ocean route. Merchandise may, however, be shipped over the Wilson line to Hull, England, where it is transferred to steamers for Stettin, Germany. Between Stettin and Roumanian cities a so-called "overland rapid service" is maintained, the time between Stettin and Bucharest being 11 days.

Freight rates vary considerably from time to time. The present rate from New York to Constantinople is 27s. 6d. (\$6.69) net per ton of 40 cubic feet. The rate from Constantinople to Bucharest via Constantza is 47 francs (\$9.07) per metric ton. The latter rate includes all transshipment charges and dock fees at Constantinople and Constantza. The reason for the high rate is the railroad freight from Constantza to Bucharest, the rate from Constantinople to Constantza being only 12 francs (\$2.32) per metric ton. The rate from Manchester to Bucharest by the ocean route is \$18.33, and by the "overland rapid service" \$25.28 to \$27.02, according to the size of the shipment. The rate from New York to Constantinople as given above is per measurement ton, the rate per metric ton weight will be somewhat more, as 40 cubic feet of cotton goods weigh about 20 per cent more than a metric ton. On the whole, however, the rates from New York to Roumania are but little more than the rates from England. All of the rates quoted apply to cotton goods. The rate on agricultural machinery from New York to Galatz varies from 17s. to 27s. (\$4.14 to \$6.57) per ton of 40 cubic feet.

BULGARIA.

GENERAL TRADE CONDITIONS.

The total foreign trade of Bulgaria in 1910 amounted to \$59,137,000, of which the exports were valued at \$24,907,000 and the imports at \$34,230,000. The increase in Bulgaria's foreign commerce from 1880 to 1910 is shown in round numbers by the following table:

Years.	Imports.	Exports.	Years	Imports.	Exports.
1880.....	\$9,307,000	\$7,357,000	1906.....	\$20,936,000	\$22,113,000
1885.....	8,500,000	8,661,000	1907.....	24,060,000	24,240,000
1890.....	16,314,000	13,713,000	1908.....	25,119,000	21,675,000
1895.....	13,321,000	14,994,000	1909.....	31,963,000	21,685,000
1900.....	8,944,000	10,418,000	1910.....	34,230,000	24,907,000
1905.....	23,594,000	28,556,000			

PRINCIPAL IMPORTS AND EXPORTS.

The value of the principal articles imported and exported in 1910 is shown in the following table:

Articles.	Imports.	Exports.	Articles.	Imports.	Exports.
Animals, live.....	\$188,167	\$1,413,596	Earthen, china, and glass ware.....	\$991,969	\$9,865
Alimentary products of animals and fish.....	432,952	2,509,314	Minerals, metals, and metal products.....	4,496,612	217,554
Cereals and grain, and products thereof.....	561,848	15,596,557	Timber, wood, and wood-ware.....	1,349,649	126,549
Fruits, vegetables, plants, and seeds.....	627,475	594,858	Paper and paper products.....	728,004	1,116
Provisions and groceries..	1,997,236	396,755	Hides, skins, and manu- factures of.....	1,773,191	788,665
Wines, liquors, and bev- erages.....	60,328	10,192	Textile materials, and products of.....	9,530,874	1,937,122
Preserves, cakes, and sweets.....	494,076	2,211	Rubber, gutta-percha, and products thereof...	287,791	63
Waste products and offals.	38,160	74,247	Railway cars, automo- biles, boats.....	754,612	4,594
Fuel.....	638,779	35,443	Machines, apparatus, and instruments.....	3,816,953	45,068
Chemical products.....	375,589	1,550	Toys and small wares....	258,039	200
Tanning and dyeing ma- terials, colors, and var- nishes.....	482,750	54,348	Works of art.....	191,999	10,918
Resins and gums.....	985,970	805	Gunpowder, explosives, and munitions of war...	1,059,494	.....
Oils, fats, wax, and prod- ucts thereof.....	1,558,536	2,893	All other articles.....	257,790	106
Medicinal materials and drugs.....	210,526	213			
Perfumery and toilet arti- cles.....	80,475	1,072,183	Total.....	34,229,844	24,907,075

Textiles are by far the largest single item of goods purchased abroad, followed by metals and metallic products; machinery; provisions and groceries; hides, skins, and manufactures thereof; and oils, fats, and wax, in the order named. Cereals constitute the bulk of the exports, followed by animal products, textile materials (chiefly silk cocoons, raw wool, and coarse woolen goods), and perfumery.

SHARE OF PRINCIPAL NATIONS IN BULGARIA'S TRADE.

The distribution of Bulgaria's foreign trade in 1906 and 1910 may be seen from the following statement of imports and exports, by countries:

Countries.	Imports.		Exports.	
	1906	1910	1906	1910
Austria-Hungary.....	\$5,365,786	\$9,181,396	\$1,582,600	\$1,510,804
Belgium.....	594,054	1,641,851	3,887,406	4,042,192
France.....	1,036,989	2,962,164	1,732,561	1,744,527
Germany.....	3,131,425	6,585,100	2,974,130	2,744,074
Greece.....	43,232	80,253	1,876,153	1,223,620
Italy.....	1,069,799	1,320,699	753,665	350,874
Netherlands.....	121,204	327,521	18,914	227,161
Roumania.....	649,445	1,268,589	216,353	167,717
Russia.....	897,257	1,324,945	59,058	58,093
Servia.....	271,744	439,110	112,712	77,972
Switzerland.....	213,844	297,220	121,783	39,372
Turkey.....	3,484,036	4,067,632	4,187,907	8,546,619
United Kingdom.....	3,782,993	4,377,626	2,892,105	2,955,795
United States.....	89,745	164,822	264,796	215,581
All other countries.....	183,929	200,856	1,432,446	1,002,674
Total.....	20,935,482	34,229,844	22,112,589	24,907,075

In the import trade Austria-Hungary ranks first, Germany second, the United Kingdom third, Turkey fourth, and France fifth, while Belgium, Russia, Italy, and Roumania have a considerable amount of trade. Formerly England held second place, but in recent years this position has been taken by Germany. British goods are well known in Bulgaria, but because English manufacturers have not catered to the demands of the people as carefully as the Germans the latter have succeeded in capturing a large part of the trade which the British had previously enjoyed.

The United States has only a small share of the trade, but the amount is steadily increasing. Statistics for 1911 have not yet been published, but during the first quarter of that year the imports from the United States were \$60,000 more than in the corresponding period of the preceding year. Bulgarian statistics show only the direct trade with the United States, but American goods are distributed from central points in other European countries, such as London, Paris, Berlin, Vienna, and Fiume, and they are credited to the nation from which final shipment is made rather than to the country of origin. One man told me that he bought a number of American articles each year, but that he always bought from London, from which place the goods were shipped. Another stated that all the agricultural implements of American manufacture that he bought were shipped from Fiume.

DIRECT TRADE WITH THE UNITED STATES.

The following table, compiled from Bulgarian statistics for 1910, shows the direct trade with the United States, and gives an idea of the American merchandise sold here and the Bulgarian goods that find a market in the United States. Among the articles of export is

coarse woollen cloth called "chayak," which is ultimately consumed by Bulgarians in the United States.

Articles.	Value.	Articles.	Value.
IMPORTS.		EXPORTS.	
Agricultural machinery.....	\$110,273	Attar of roses.....	\$139,419
Sewing machines.....	17,394	Copper ore.....	32,756
Steam engines and traction engines.....	13,224	Goat and lamb skins.....	25,828
Miscellaneous machinery and tools.....	10,050	Leaf tobacco.....	12,555
Automobiles.....	2,161	Coarse woollen cloth.....	4,222
Metals and metallic articles.....	2,056	All other articles.....	790
Molasses and sirups.....	1,963		
Shoes and shoe leather.....	1,718		
Furniture.....	1,156		
Cotton manufactures.....	1,021		
Petroleum and unrefined oil.....	900		
Cottonseed oil.....	444		
All other articles.....	2,465		
Total.....	164,822	Total.....	215,581

SALES OF AMERICAN MACHINERY.

The total value of all the agricultural machinery imported in 1910 was \$508,763, of which Austria-Hungary furnished \$176,094, the United Kingdom \$114,062, and the United States \$110,273. As a large part of the Austro-Hungarian imports were shipped from Fiume, which is a distributing point for American goods, it is safe to assume that the United States holds second position at least, and it was the opinion of many dealers in agricultural machinery that American farming machinery and implements are more largely used than those of any other country. The fact that there are not many large farms in Bulgaria, the land being divided up among a number of small owners, has been an obstacle to the sale of reapers, steam plows, tractors, and other high-priced machinery. In some parts of the country, however, large holdings are becoming more numerous, and, even if the farmer is not well-to-do, he may be able to purchase improved implements through credit extended by the Banque Agricole. The latter is an institution for the particular benefit of the farmers, to whom its loans in 1910 exceeded \$5,000,000.

American thrashing machines are much preferred, because they are considered more practical. Formerly American thrashers were not sold, because they did not have an attachment for bruising the straw. This defect has now been remedied, and the attachment on the American machines is claimed to be superior to all others and puts the straw in such shape that it can readily be used for cattle feed. Steam plows are rare, but recently there have been some inquiries for them. The ground in most parts of the country is very hard, and plows must be specially adapted to prevailing conditions. This the Germans have done, and they now have a practical monopoly of the horse-plow trade in Bulgaria. There is a splendid market for mowers, corn shuckers and shellers, and small farming implements and tools; moreover, the demand is rapidly growing because of the increasing agricultural production of the country.

American interests appear to be insufficiently represented, and the field has not been given the attention it deserves. A number of firms

in Bulgaria would like to represent American dealers and manufacturers, but it is a difficult matter to establish satisfactory business relations except by sending a representative here to demonstrate the good qualities of the machines and implements and to make the changes necessary to adapt them to the country. Of Bulgaria's total area of 24,380 square miles, more than one-third is under cultivation, and 75 per cent of the total population of 4,317,000 are engaged in agricultural pursuits. Only in recent years have the peasants begun to adopt modern methods of cultivation, and primitive and antiquated tools are still largely used.

There is also a splendid opportunity in Bulgaria for the sale of small steam and oil engines for use in the numerous small industries, such as flour mills, sawmills, brickmaking works, shoe factories, and chemical works. The engines generally required are those of 10 to 30 horsepower, and an engine using crude oil for fuel is very popular, owing to the fact that a good supply of oil is obtainable in Roumania.

COTTONSEED OIL—BUILDING MATERIALS.

The greatest opportunity to increase American trade here at present is in cottonseed oil. Until quite recently Bulgaria absolutely prohibited the importation of this oil for edible purposes, on account of the prevalent opinion that it was harmful. Owing largely to efforts of the American chargé d'affaires the restrictions have now been removed, and a customs duty of 15 francs per 100 kilos (\$1.318 per 100 pounds) on edible cottonseed oil and 5 francs per 100 kilos (\$0.438 per 100 pounds) when it is denatured is levied. The tariff on olive oil, the nearest competing article, is 10 francs per 100 kilos (\$0.88 per 100 pounds) if in barrels or jars and 18 francs per 100 kilos (\$1.58 per 100 pounds) if in bottles. The United States enjoys the most-favored-nation treatment in the tariff, and there is no discrimination against cottonseed oil, as in the case of Roumania.

Nearly all the business firms I visited in connection with the subject stated that large quantities of this oil can be sold here, and they were anxious to secure the agency for American cottonseed oil manufacturers. It is highly important, however, that generous samples be sent, because it is a new and untried article, and a certain amount of local prejudice must be overcome. One or two dealers wrote to American manufacturers requesting samples, and the request was complied with only to the extent of mailing small bottles of the oil, which were totally inadequate for the purpose desired. [The names of firms desiring to represent cottonseed oil manufacturers may be obtained from the Bureau of Manufactures.]

Furniture and building materials are very much in demand. Bulgaria became an independent nation only in 1908, but the progress of the country in recent years has been marvelous. Within the past few years country districts have been connected with the business centers by telegraph, railroads have been constructed, steamship lines inaugurated, and hotel accommodations perfected. In three decades the nation has built more than 5,000 schools, in which more than 500,000 pupils are instructed. It has established and now maintains a standing army of 120,000 men, and has built more than 1,500 miles of railway. Foreign commerce has increased nearly threefold since 1880. The

country's agricultural products are being sold in all parts of Europe, while the attar of rose industry in the "rose valley" of Tunja is world renowned. Sofia, the capital of the country, is to-day a modern city, with broad, attractive boulevards, well-paved streets, and buildings that would do credit to a much larger city. It is one of the chief commercial centers in the country, and the population between 1905 and 1910 increased from 82,000 to 102,000. Much building is going on, and there is a market for all kinds of building materials, particularly for wire nails, hardware, tools, flooring, roofing, heating apparatus, electrical supplies, paints and varnishes, and office furniture. An important dealer in Sofia stated that there is a large demand for wire nails and that the American product is preferred above all others.

WIDENING OF MARKET—FACTORS FAVORING AMERICAN TRADE.

The improved condition of the Bulgarian people under the new régime has widened, and will continue to widen, the markets for goods in all lines. American shoes are just beginning to be sold here, and American rubbers and goloshes, which are worn very generally in the winter, are preferred. There is a demand for a cheap, substantial automobile. Nearly 100 American cars have been sold here by one agent. American starch, glucose, and dextrine are on this market, but business can undoubtedly be increased. Several firms are anxious to form connections with American manufacturers of these articles. Other things that can be sold are small pumps, silver-plated ware, kitchen utensils, upper leather for shoes, leather belting, lubricating oil and greases, steel rails, and tools of all kinds.

Several factors seem to favor the development of American trade in Bulgaria, foremost of which is the good reputation that our products enjoy. The few goods now sold here have won considerable favor, and business firms are eager to sell American merchandise. Another factor is the emigration from Bulgaria to America, the statistics showing that in 1907 (the latest figures available) 17,350 persons left Bulgaria for the United States. The United States is one of Bulgaria's chief customers for two of its principal exports—copper and attar of roses. Furthermore, American influence has been felt in the country by reason of the fact that a number of Bulgarians have been educated at Roberts College, an American institution in Constantinople. American missions and schools have been established in the country and are playing no small part in the development of the nation.

There is no obstacle to the extension of American trade in Bulgaria, and there is every reason to believe that it might be considerably augmented. However, it is well to call attention to the fact that American goods are to a large extent unknown, and the same care must be exercised, the same methods adopted, as in the introduction of any new and untried article. The indifference of American manufacturers and their failure to appreciate this fact have discouraged many Bulgarian firms who have endeavored to do business with them. Requests for information are often replied to by a circular or mimeograph letter. Catalogues are sent, printed in English and with prices in dollars, making them practically valueless to in-

quirers who are unfamiliar with our language. In discussing the latter point, one man stated that it was not difficult to find some one to translate letters and catalogues, but not infrequently the matter was of such a nature that he did not feel inclined to show the letters to an outsider who, if the proposition was a good one, might take up the matter himself. French is taught in all the State schools, and correspondence and catalogues to be understood should be in French or in German, while quotations should be in francs, the Bulgarian lev having the same value as the franc (\$0.193). Weights should be in kilos, because the metric system is in general use, and tariff duties are levied in accordance with it. When weights are given in pounds it causes considerable confusion and sometimes loss, because the customs authorities impose heavy penalties for false statements of weights.

AGENCIES—CREDIT TERMS.

The practice of giving a general agency for the Levant and the Near East has hindered the extension of American trade here. Bulgarian firms desire to deal with the manufacturers direct, and they seem to be particularly averse to dealing through agents in Constantinople. In efforts to secure business here American manufacturers should realize that while we have seemingly regarded Bulgaria as an unimportant field for trade, other nations have been exploiting the market, and competition is becoming sharper all the time. The English secured their trade by canvassing the country thoroughly and by extending long credits. But even after they ascertained the particular requirements of the people they failed to cater carefully to them and insisted that the Bulgarian customers purchase goods manufactured to meet British conditions and tastes rather than those adapted to Bulgaria's people. German manufacturers, on the contrary, have endeavored to please the peculiar tastes of the people and to suit their products to conditions obtaining here. In addition they offer as liberal terms as the English. As a result of this policy German trade is steadily increasing, while that of England is growing much less rapidly than formerly.

It is very difficult to do business in Bulgaria on a cash basis, because wholesale dealers and importers are obliged to extend credit to their customers. American goods paid for on date of shipment do not arrive here until at least two months later, and when disposed of are sold on terms of six months' credit. It is therefore eight months at the least before the buyer receives any return on his outlay. Several business men expressed a willingness to pay for goods on arrival or to pay in 30 days after shipment through a bank in Bulgaria, and it is believed that considerable business might be done on this basis. A number of firms here that are strong financially do not consider it a good and fair investment to pay for goods on which they receive no return for eight or nine months.

COTTON-GOODS TRADE.

Of the textiles imported by Bulgaria cotton manufactures are by far the largest and most important item, forming more than 50 per

cent of the total. The following table shows the value of the various classes of textiles imported in 1910:

Articles.	Value.	Articles.	Value.
Raw cotton and waste.....	\$291,397	Cocoons and raw silk.....	\$1,253
Cotton yarn and thread.....	2,128,244	Silk yarn.....	23,408
Cotton cloth and miscellaneous goods.....	2,903,996	Silk goods.....	296,568
Total.....	5,323,637	Silk clothing.....	35,659
Raw and combed wool.....	431,640	Total.....	326,238
Woolen yarn.....	432,109	Mixtures.....	582,354
Woolen goods.....	1,134,556	Ties and cravats.....	11,570
Woolen clothing and lingerie.....	138,626	Corsets.....	18,383
Total.....	2,136,941	Hats, caps, and millinery.....	274,411
Raw hemp, flax, and jute.....	76,267	Artificial flowers.....	22,240
Yarn of flax, hemp, and jute.....	245,368	Hair and hair products other than wool.....	16,240
Cloth and bags of flax, hemp, and jute.....	494,369	Total.....	925,169
Clothing and lingerie.....	2,636	Grand total.....	9,530,674
Total.....	818,840		

The bulk of the woolen goods purchased abroad consists of medium and fine qualities, Germany and Austria-Hungary supplying more than 80 per cent while the United Kingdom ranks third in the trade. All the coarser grades are manufactured in Bulgaria, principally by peasants on their hand looms or in the numerous small factories. There are 35 or 40 factories, with a total capital of \$675,000 and employing 3,000 operatives.

Linen goods come mostly from France, while the United Kingdom, Austria-Hungary, and Italy are the chief suppliers of hemp and jute bags and twine. France, Switzerland, and Austria-Hungary, in the order named, dominate the trade in silks.

SOURCE OF COTTON-GOODS IMPORTS.

The following table shows the value of the imports of cotton and its manufactures in 1910, by articles and countries:

Articles.	United Kingdom.	Austria-Hungary.	Italy.	Turkey.	Germany.	Other countries.	Total.
Raw cotton.....	\$135,527	\$1,175	\$248	\$86,676	\$102	\$48	\$223,776
Cotton waste.....	396	15,553	1,282	1,176	923	456	19,736
Cotton, carded or combed.....	167	132	18,858	2,956	1,395	25	157
Cotton wadding.....		23,717				1,465	47,673
Total.....	136,090	40,577	20,388	89,908	2,420	2,014	291,397
Cotton yarn:							
Single—							
Gray—							
Up to No. 12.....	62,606	37,485	241,059	265,975	1,036	15,475	623,636
No. 12 to No. 30.....	472,185	12,075	134,097	4,398	5,283	1,319	629,357
Above No. 30.....	2,521	9			421	395	3,346
Bleached or dyed—							
Up to No. 12.....	95,258	48,951	54,928	3,730	10,181	7,267	220,315
No. 12 to No. 30.....	193,341	4,292	10,891	22	2,742	4	211,392
Above No. 30.....	44,222	452	301		1,375	12	46,362
Twisted, gray, bleached, or dyed.....	44,995	97,797	44,573	202	48,179	3,189	238,935
Sewing thread.....	72,819	19,377	5,509	375	39,471	9,384	146,935
Lamp wicks.....		2,691			747	156	3,594
Twine and cord.....	951	1,409	114	46	1,393	839	4,472
Total.....	988,898	224,538	491,472	274,748	110,828	37,760	2,128,244

Articles.	United Kingdom.	Austria-Hungary.	Italy.	Turkey.	Germany.	Other countries.	Total.
Cotton cloth:							
Coarse—							
Gray.....	\$47,489	\$570	\$11,576	\$463	\$82	\$816	\$60,976
Bleached or dyed.....	107,833	67,077	88,877	3,803	31,051	38,189	336,830
Fine—							
Gray.....	106						106
Bleached.....	245,547	31,322	11,393	1,055	2,989	2,840	295,146
Colored.....	188,037	140,974	49,822	890	47,651	9,609	436,783
Printed goods, calico, barchent, and printed flannels.....	423,681	287,258	95,828	14,193	100,243	98,394	1,019,597
Cotton velvet.....	17,376	20,332	990	19	21,548	35,215	95,480
Head shawls.....	1,856	3,149	8	34,168	1,186	6,004	46,371
Shawls, girdles, and turbans.....	75	5,646	125	6,994	1,675	1,821	16,336
Tissues for curtains.....	3,138	4,539		43	520	864	9,104
Bed and table covers, towels, napkins, and handkerchiefs:							
Of cotton.....	64,228	36,756	2,262	7,391	18,205	12,058	140,900
Of cotton mixtures.....	366	2,749	109	26,455	907	1,248	31,834
Sheets, pillows, and mattresses.....	30	241		1,651	140	127	2,189
Laces and embroideries:							
Of pure cotton.....	19,311	39,533	1,537	280	43,672	23,519	127,852
Of mixtures.....	241	4,112	1	290	8,688	2,487	15,819
Cotton trimmings and buttons.....	476	13,681	7,675	242	13,542	2,489	38,106
Materials for surgical dressings.....	2	13,900	1,437	3	6,068	965	22,405
Gloves, hosiery, and knit goods.....	229	10,556	906	159	32,520	2,451	46,821
Cotton tissues, mixed with silk, linen, wool, etc.....	5,047	8,377	14,956	9,627	9,531	7,519	55,057
Cotton clothing.....	491	21,427	22	677	9,892	9,002	41,511
Cotton lingerie.....	159	50,814	754	522	7,379	5,146	64,774
Total.....	1,125,718	763,013	288,078	108,925	357,499	260,763	2,908,996
Grand total.....	2,250,706	1,028,128	799,938	473,581	470,747	300,537	5,323,637

Included in the item "other countries" are imports from France valued at \$100,183, chiefly velvets, fine cotton goods, and damask; and from Switzerland \$59,190, mainly laces and embroidery and coarse colored goods. Other nations sharing in the trade are Russia, Spain, Belgium, and the Netherlands. Imports from the United States were insignificant and consisted of coarse gray cloth valued at \$791 and fine colored goods valued at \$114.

METHODS FOLLOWED BY DIFFERENT COUNTRIES.

The foregoing table enables one to comprehend at a glance the varieties of cotton manufactures sold on this market. The United Kingdom has approximately 40 per cent of the total trade. This predominance is due to the facts that: (1) England was first in the field, its goods are well known, and Manchester firms have had agents here for a number of years who keep in close touch with the market; (2) in certain lines other countries are unable to compete; (3) many of the most important buyers in Bulgaria visit Manchester once or twice each year and buy their cloth direct from the manufacturers and have it bleached, printed, or otherwise converted to suit their particular requirements. Usually a commission merchant is employed, who pays the manufacturer and converter and extends six months' credit to the buyer. The commission man also pays packing and loading expenses, insurance, and freight to Varna or Bourgas, for all of which, including interest charges, he receives 10 per cent commission.

The trade of Austria-Hungary, Italy, and Germany is conducted on a different basis. While many of the manufacturers in those coun-

tries have agents on the ground, entire dependence for business is not placed in them. Salesmen are sent out in the spring and fall with a full line of samples to take orders, liberal terms of credit are given, and small orders are accepted, a policy which has secured much business from smaller firms that are not in a position to buy from England in the manner described. There is, in fact, a disposition to deal with other countries than England whenever possible, because British manufacturers do not conform to local requirements as regards weights and measures. English goods are put up in yard rather than meter folds, and weights are expressed in pounds rather than kilos. This results in more or less confusion, because of the universal use of the metric system and because customs duties are levied by the 100 kilos of weight.

The trade of England extends to practically all lines, but its chief exports to Bulgaria are gray, bleached, and dyed yarn from No. 12 to No. 30, sewing thread, fine bleached and colored goods, and cheap prints and calico. Austria-Hungary furnishes twisted yarn, bleached and dyed single yarn, and the finer grades of colored and printed goods and velvets. Italy supplies coarse yarns and the cheaper varieties of prints and colored goods. Turkey's share of the trade is practically confined to yarn up to No. 12, which comes mainly from Saloniki, head shawls, and fancy table and bed covers, most of which are handmade and elaborately embroidered. Part of the goods credited to Turkey really represents English and Italian goods that have been bought by agents in Turkey and reshipped. Special twist and fancy colored yarns, sewing thread, and the better grades of prints, flannels, velvets, and colored cloth come from Germany.

DOMESTIC PRODUCTION—CLASSIFICATION OF IMPORTS.

As regards quantity, the imports of yarn considerably exceed those of cloth. In 1910, for example, 9,767,325 pounds of yarn were purchased abroad, as compared with 6,364,261 pounds of cloth and miscellaneous manufactures. The large sales of yarn are due mainly to the extensive use of hand looms by peasants. The raw cotton and a small proportion of the yarn imported are used by the local cotton industry. There is one spinning mill and one weaving mill at Varna and a weaving mill at Jamboli. The first and third are financed and managed by Englishmen, while the second is in the hands of a Bulgarian. The looms, however, number only 500 and the spindles 15,000, and the industry at present does not play a very important part in the cotton-goods trade of the country. The production is chiefly the so-called "Americana" cloth, or coarse sheeting.

No distinction is made in the Bulgarian statistics as regards the construction of the cloth. The classification coarse gray goods includes "Americana" and other coarse sheeting and drills, sail cloth (called *elken-besi*), and canvas. Goods classed as coarse bleached and colored goods include those that have been converted after weaving, such as bleached sheetings, the coarser grades of linings, cambric, muslin, madapollam, tanjibs, tarlatan and similar goods, and the cheaper qualities of calico and cloth dyed in one color. Most of the printed goods, calico, and printed flannels are classed under a separate heading. The item "fine bleached and colored goods" includes

finer muslin, madapollam, and batiste, and such cloth as oxfords, zephyrs, stripes, percale, and fine figured goods.

TRADE IN GRAY GOODS.

Much of the coarse gray goods consumed in the country is supplied by the peasants themselves, imports being confined to T cloth, long cloth, drills, and a sheeting usually known as "cabot," an imitation of a well-known American brand. T cloth is usually 24 yards long and 32 to 34 inches wide, with from 48 by 48 to 56 by 56 threads per inch and with the usual colored stripe head end. There is no special preference as regards the kind of heading, but practically all that I examined had the national colors (red and green), each color being about 1 inch wide on the cloth. The bulk of this class of goods comes from Manchester.

The so-called "cabots" are usually put up in 40-yard lengths, are 34 to 40 inches wide, and retail at 18 to 20 francs (\$3.48 to \$3.86) per piece, or 8.7 to 9.6 cents per yard. While some of these goods seem to be of fairly good quality, they are generally inferior to the genuine article. They come mostly from Italy and England. The real American "Cabot" brand is little known on the market, and dealers with whom I talked were apparently surprised to learn that the word originated in the United States. One prominent importer stated that the name had been brought in by the Turks, a large number of whom live in Bulgaria. I showed samples of the genuine "Cabot A" brand to the trade, and the opinion prevailed that it was superior to the article sold here and that it could compete as regards price. The tariff on this class of goods is 40 francs per 100 kilos, or 3.5 cents per pound. The imitations of the original brand are poor and are not calculated to deceive anyone who has seen the American Cabot. I saw goods marked "Cabots," "Prima Cabots," etc., but the words usually appeared in rather small letters at the middle or bottom of the outside fold, and in no respect did they resemble the brand on the original.

CLASSES OF IMPORTED GOODS IN GREATEST DEMAND.

By far the larger part of the cotton goods imported by Bulgaria consists of prints and calicoes, flannels, and barchent (a flannel napped on one side and printed on the other). Generally speaking, the peasants, who form the bulk of the country's population, adhere to the native costume. The women wear elaborately embroidered blouses and skirts, with undergarments of cotton, the former of hand manufacture. Head shawls and coarse, fancy-colored stockings are knitted at home. However, an increasing number of these people are beginning to buy cheap printed goods for summer and flannelets or barchent for winter, reserving their native costumes for fêtes and holidays.

All of the nations share in the trade, but England and Italy predominate in the cheaper grades, which are most widely used, while the better qualities come from Austria-Hungary and Germany. The goods are usually packed in 40 or 45 meter (43.7 or 48.3 yard) pieces and are put up in both long and narrow (book) folds. They are

27 to 30 inches wide, weigh 6 to 8 yards per pound, and generally have a stiff finish. Prices range from 40 centimes per meter (7 cents per yard) for the cheaper grades to 70 and 80 centimes per meter (12.3 and 14.1 cents per yard) for the fine qualities. Blue in all shades and red are the most popular colors. Another variety of print or piece-dyed goods used for women's skirts has a 6 or 8 inch fancy border on one side of the cloth. Sometimes the cloth is dyed in a solid color, with the border printed on the side, a sample of which is furnished. It is of Austrian manufacture, is 35 inches wide, and retails at 80 centimes per meter (14.1 cents per yard). American prints could not be found on the market, although one importer stated that recently he had ordered 500 pieces from a Manchester firm; inquiry disclosed the fact that most of the American cloth reaching Bulgaria is purchased through English agents.

INTRODUCTION OF AMERICAN PRODUCTS.

Among importers the idea prevails that American goods are too high in price to compete, but this opinion appears to be based on hearsay rather than positive information, because American manufacturers do not appear to have made any serious effort to bring their goods to the attention of the trade. Freights from the United States are only slightly higher than the rates from England, the United States enjoys the minimum tariff, and our failure to sell here is due more to indifference and the lack of proper efforts than to natural obstacles. If travelers with complete lines of samples were sent here to canvass the trade and select good resident agents, if they came prepared to quote prices c. i. f. Varna or Bourgas, and if they were willing, when necessary, to accept fairly small initial orders, a satisfactory business could be done in such goods as prints, cheap gingham, flannelets, and denims and cottonades.

Best results could be obtained by permitting the purchaser to pay the invoice on arrival of the goods, through a draft with shipping documents attached consigned to the Imperial Ottoman Bank or the Credit Lyonnaise in Constantinople, both of which institutions have correspondents in Bulgaria. In order to secure a foothold in this market it is essential that American manufacturers meet existing conditions rather than attempt to change these conditions to suit themselves, or make their usual demand of cash on shipment of goods. At present no great volume of business can be done on the latter basis, but this should not deter American manufacturers from entering the market; safe and satisfactory credit arrangements can undoubtedly be made, as they have been by manufacturers in other countries.

American trade in cotton goods and in all other lines is hampered by the fact already mentioned, that frequently the general agency for the Balkans and Turkey is given to a firm in Constantinople or Saloniki. Having secured the agency these representatives not infrequently give very little attention to the development of trade beyond the borders of Turkey. It should be borne in mind that Roumania, Bulgaria, and Serbia are three separate and distinct countries, with different languages, different customs, and different tastes. The people are more or less suspicious of foreigners, and whenever possible it is advisable to do business through a native Bulgarian, Roumanian, or Servian agent.

KNIT GOODS AND MISCELLANEOUS MANUFACTURES.

What has been said of piece goods applies also to miscellaneous cotton manufactures and small wares. While the trade in the former is the larger, the demand for small wares is gradually increasing. Underwear and the very coarse grades of hosiery are still made at home by the peasants; for the finer grades of hosiery and knitted gloves the people depend on purchases from abroad, the bulk of these articles being supplied by Germany. American seamless hosiery selling at 40 to 50 cents a pair would find a good market here, while haberdashery, if put up attractively and well advertised, would undoubtedly find favor with the more well-to-do class of people, who are rapidly increasing in number. One dealer expressed a desire to buy towels and toweling in the piece from the United States. He wanted it in this shape because it enjoys a lower rate of duty than made-up articles. In all these lines American goods, backed by American advertising, would soon bring satisfactory returns.

TRANSPORTATION AND FREIGHT RATES.

There is no direct steamship line between the United States and Bulgarian or other Black Sea ports, and goods for the Balkans are transhipped at Liverpool, Naples, Trieste, Piraeus, or Constantinople. The Johnson Line has fortnightly sailings from Liverpool, and the time of passage to Varna is about four weeks. The rate from Liverpool by this route is now 45 francs (\$8.78) per metric ton. Quicker delivery can doubtless be obtained by shipping via Trieste, Piraeus, or Constantinople. Between each of these ports and points on the Black Sea the Austrian Lloyd maintains a service with sailings every two weeks. From Constantinople to Bourgas or Varna the rate is approximately 10 francs (\$1.93) per metric ton. As the present rate on cotton goods from New York to Constantinople is quoted at 27s. 6d. (\$6.70) per ton measurement, it would appear that American goods can be shipped to Bulgaria as cheaply as English goods. The difference, however, is more real than apparent, because large consignments from Liverpool are frequently shipped at a lower rate than the published tariff. Rates are also lower in the spring, when large cargoes of grain are being shipped to English, Belgian, and German ports, and goods are brought in at a reduced rate to avoid the necessity of the ships returning empty. In 1910, 40 per cent of the imports entered Bulgaria through the port of Varna, 16 per cent through Bourgas, 25 per cent through Sofia, and 13 per cent through Rustchuk, situated on the Danube. The latter is a very important commercial city in Bulgaria, owing to its advantageous geographical position. Goods are brought down the Danube from Austria-Hungary, on the one hand, and up from the Black Sea on the other. As regards the importation of textiles, the rank of the principal cities was Varna, Sofia, Rustchuk, Phillippopolis, and Bourgas, in the order named.

CUSTOMS DUTIES.

Customs duties in Bulgaria are specific and are levied on the net weight of the goods. The amount of tare to be deducted on various articles is specifically stated and ranges from 5 to 6 per cent in the

case of cotton manufactures. The rates of duty on cotton and cotton goods under the conventional tariff, which applies to merchandise from the United States, are as follows:

Articles.	Rate of duty per 100 kilos.	Rate of duty per 100 pounds.
Cotton, raw or carded, and cotton waste.....	<i>Leva.</i> 20	\$1.75
Cotton yarn, single, unbleached, undyed:		
Up to No. 14.....	25	2.19
No. 15 to No. 24.....	25	2.19
Above No. 24.....	40	3.50
Cotton yarn, twisted, unbleached, undyed:		
Up to No. 14.....	28	2.45
No. 15 to No. 24.....	30	2.65
Above No. 24.....	50	4.38
Cotton yarn, single or twisted, bleached:		
Up to No. 24.....	35	3.07
Above No. 24.....	55	4.82
Cotton yarn, single or twisted, dyed or printed:		
Up to No. 24.....	45	3.94
Above No. 24.....	65	5.69
Sewing thread, in hanks:		
Bleached.....	36	3.16
Dyed.....	60	5.25
Sewing thread, in balls or on bobbins.....	90	7.88
Cotton fabrics:		
Unbleached, undyed.....	40	3.50
Bleached or dyed after weaving, in one color.....	55	4.82
Lawn and other fabrics for lining.....	35	3.07
Cotton fabrics, such as gauze, tarlatan, batiste, and similar goods.....	55	4.82
Cotton fabrics, manufactured with dyed yarn, such as oxfords, vocasines, stripes.....	65	5.69
Cotton printed goods, including flannels, calico, percaline, cretonne, printed handkerchiefs, and printed reps.....	75	6.57
Printed flannelets weighing from 140 to 200 grams per square meter (4.13 to 5.9 ounces per square yard).....	70	6.13
Light fabrics, embroidered, gray, bleached, dyed or printed.....	100	8.75
Printed head shawls.....	300	26.26
Cotton velvets and plushes.....	140	12.25
Curtains, towels, sheets, and similar articles, made up, bleached or dyed.....	100	8.75
Shawls, girdles, and turbans.....	175	15.34
Cotton knit goods.....	225	19.69
Cotton trimmings, braids, and ribbons.....	190	16.64
Laces, tulle, and embroidery.....	350	30.64
Made-up articles of cotton.....	(¹)	(¹)

¹ Four times the duty on the material.

SERVIA.

GENERAL TRADE CONDITIONS.

In area and in the value of its foreign trade Servia is the smallest of the three Balkan States. The area of the country is 18,650 square miles, or about one-half that of the State of Indiana, and the population is 2,700,000. More than 80 per cent of the people are dependent on agriculture, and only about 350,000 live in towns. The principal products are corn, wheat, barley, oats, hemp, and plums and other fruits. The land is divided up into a number of small farms, the holdings of the peasants varying in size from 10 to 30 acres.

Servia has considerable mineral resources, including coal, copper, lead, gold, and silver, but the development of the mining industry has been retarded by lack of capital, the bad condition of the country roads, and the absence of an extensive system of railways. More than half the copper output is purchased by the United States, the exports thereto in 1910 being valued at \$824,000. The mines now worked yield a good profit, and it is the opinion of experts who have visited the country that the field offers splendid opportunities to a company that will undertake to provide means of transportation and mine the copper by the most improved methods. Several small industries are carried on, most important of which is flour milling. There are also breweries, sugar works, shoe factories, and several textile weaving mills. For the establishment of industries the Government grants concessions that provide for free land for building sites, exemption from customs duties on machinery and raw materials, reduced freight rates on railways, and the privilege of filling Government contracts at rates 10 per cent higher than the average. However, in spite of these privileges, development along industrial lines has been inconsiderable, and Servia remains primarily an agricultural country.

Belgrade, the capital, has a population of 85,000 and is the chief commercial center, the only other town of importance being Nisch, with 22,000 inhabitants. The Servian language is used throughout the country, but German is spoken by practically all the business men and merchants. The metric system was adopted in 1875 and has been in general use since 1883. The Servian dinar is equal in value to a franc (\$0.193).

SERVIA'S FOREIGN TRADE.

The total foreign trade of Servia in 1910 was valued at \$35,135,147, imports being \$16,146,258, and exports \$18,988,889. Of the imports Germany supplied 41.3 per cent, Austria-Hungary 19 per cent, the United Kingdom 13.49 per cent, Turkey 7.01 per cent, and Italy 4.30 per cent. Servia's principal customers are Turkey, Germany,

Austria-Hungary, Belgium, Roumania, the United States, and Bulgaria, in the order named. Formerly Austria-Hungary had the bulk of the trade in both imports and exports, but owing chiefly to tariff controversies conditions have changed, and first position is now held by Germany. In 1905, for example, the imports from Austria-Hungary amounted to 60 per cent of the total, and the exports to Austria-Hungary 89 per cent, while the corresponding figures in 1910 were 19.07 and 18.11 per cent.

The value of the exports to the United States in 1910, as shown by consular invoices, was \$907,624, as compared with \$125,323 in 1906. Copper constitutes the bulk of the exports, other articles being plum jelly, regulus of antimony, and goatskins. Servian statistics give the value of the imports from America in 1910 as \$202,250, but this includes only direct trade. As most of the American goods brought into Serbia are purchased through German and Austrian agents the figures are misleading. Cottonseed oil is the chief article of American manufacture that finds a market in Serbia. Since the lowering of the duty on this oil several years ago the total imports have increased considerably, the value being \$100,600 in 1910, as compared with only \$5,602 in 1907. Of the former amount only \$59,800 was credited to the United States, but it is safe to assume that at least 75 per cent of the oil imported originated in the United States. The present conventional rate of duty on cottonseed oil is 20 francs per 100 kilos (\$1.75 per 100 pounds) or only 2 francs per 100 kilos (\$0.175 per 100 pounds) higher than the rate on olive oil. Other American articles sold here are leather, sewing machines, lubricating oil, typewriters, office furniture, hardware, tools and kitchen utensils, cash registers, and boots and shoes. Several American automobiles have also been purchased, but the poor condition of the country roads and the streets in the towns do not make Serbia a good field for the sale of motor cars.

The principal articles exported from Serbia in 1910 were: Corn, \$4,381,073; wheat, \$2,496,257; barley, oats, and rye, \$1,102,816; live animals, \$1,936,257; dried plums, \$2,102,262; copper, \$1,596,217; animal products, \$1,347,381; hides and skins, \$708,171; preserved plums, \$568,699; eggs, \$443,336.

COTTON-GOODS TRADE.

Servia's imports consist mainly of manufactures, cotton goods being the leading item. The total imports and exports and the imports of cotton manufactures in recent years are shown in the following table:

Trade.	1905	1906	1907	1908	1909	1910
Total imports.....	\$11,120,128	\$9,865,728	\$14,116,665	\$14,597,635	\$14,192,272	\$16,146,258
Total exports.....	14,399,254	14,320,819	16,011,406	15,005,572	17,945,479	18,988,989
Imports of cotton manufactures.....	1,656,807	1,548,830	2,902,559	2,596,063	2,159,180	2,980,726

Other textiles imported in 1910 were wool and woollen manufactures, valued at \$1,169,394 (mainly from Germany); silk manufactures, \$283,793 (from Germany, Switzerland, and Italy); linen goods, \$111,817 (from England and Germany).

QUANTITY AND VALUE OF IMPORTS.

The following table shows the amount and value of cotton and its manufactures imported in 1910:

Articles.	Pounds.	Value.
Carded and combed cotton and cotton waste	180,760	\$16,368
Yarn:		
Single—		
Up to No. 8—		
Unbleached	223,209	34,976
Bleached	204,349	37,730
Dyed or printed	67,435	10,323
No. 9 to 20—		
Unbleached	2,799,375	551,385
Bleached	623,342	121,728
Dyed or printed	244,365	48,995
No. 21 to 30—		
Unbleached	884,792	187,661
Bleached	570,982	134,846
Dyed or printed	80,417	6,711
Above No. 30—		
Unbleached	19,559	3,180
Bleached	65,497	21,027
Dyed or printed	13,331	3,204
Twisted—		
Unbleached	38,546	8,257
Bleached	104,955	25,101
Dyed or printed	31,290	7,063
Sewing and embroidery thread	588,135	212,176
Total	6,509,579	1,414,383
Fabrics:		
Weighing more than 120 grams per square meter (3.54 ounces per square yard) and having in 1 square centimeter (0.155 square inch)—		
Up to 50 threads	1,674,662	509,791
From 50 to 80 threads	607,812	239,856
More than 80 threads	156,588	71,271
Weighing from 60 to 120 grams per square meter (1.77 to 3.54 ounces per square yard) and having in 1 square centimeter—		
Up to 50 threads	191,291	65,522
From 50 to 80 threads	589,891	274,085
More than 80 threads	37,933	20,080
Weighing up to 60 grams and having in 1 square centimeter—		
Up to 50 threads	58,458	25,744
From 50 to 80 threads	21,030	19,212
More than 80 threads	1,949	2,711
Handkerchiefs, head covers, and shawls	117,037	76,275
Velvet and plush	78,019	60,778
Tulle, bobbinet, etc.	18,675	14,128
Knit goods, all kinds	17,606	16,460
Laces and embroideries	39,776	80,875
Ribbons	26,224	23,191
Trimmings and buttons	12,183	9,815
All other manufactures	66,189	34,081
Total	3,715,322	1,549,975
Grand total	10,405,661	2,980,726

TRADE IN YARN.

In quantity the imports of yarn considerably exceed those of cloth and other goods. In Serbia, as in Roumania and Bulgaria, hand-loom weaving is engaged in extensively, and nearly every peasant has a loom on which, during the winter months especially, the coarser qualities of cotton goods used by the family are woven. The bulk of the yarn imported is 9s to 20s single gray yarn, 12s, 14s, and 16s being in greatest demand. In bleached yarns 16s to 24s are most widely sold. No. 10 English hard twist yarn is quoted at 15 cents per pound and No. 20 at 18 cents f. o. b. Liverpool. Freight and

commission amount to about 15 per cent. Austrian yarn is offered at 17.66 cents for No. 12 c. i. f. Belgrade (duty not included). The wholesale price of No. 14 among the dealers here is 13.50 francs (\$2.60) per 10-pound package.

The yarn is generally wound in skeins and put up in 5 and 10 pound packages. There is also an increasing demand for yarn wound on small pasteboard beams (30 by 5 inches), which makes it more suitable for use on hand looms. The beams usually hold 5 pounds and yarn put up in this manner is sold at 1½ cents per pound more than skein yarn. England supplies more yarn than all other competing nations combined, but recently the Italians have begun to make serious inroads on the monopoly which England has hitherto held. The Italian yarn, though cheaper, is inferior, and most of the merchants expressed a strong preference for the English product.

SOURCE OF COTTON-GOODS IMPORTS.

The share of the various nations in the cotton-goods trade is shown in the following table:

Countries.	Cotton and waste.	Yarn and thread.	Cloth.	Total.
Austria-Hungary.....	\$8,112	\$195,644	\$42,698	\$246,454
France.....		7,658	40,385	48,043
Germany.....	5,527	139,369	631,474	776,370
Italy.....	2,080	144,480	221,103	367,663
Switzerland.....		13,625	142,972	156,597
Turkey.....	182	21,321	28,896	50,399
United Kingdom.....	467	891,932	400,559	1,292,958
All other countries.....	20	354	41,888	42,262
Total.....	16,368	1,414,383	1,549,975	2,980,726

Germany holds first place in the trade in cloth and miscellaneous manufactures, furnishing more than 40 per cent of the total. In quantity of cloth the United Kingdom is not far behind, the value of Germany's exports being increased by its sales of embroidery, laces, and knit goods. Italy, Switzerland, Austria-Hungary, and France follow the United Kingdom, in the order named. In general, the better grades of gray and bleached goods, cheap prints, and oxfords come from England; the cheaper qualities of gray and bleached goods, barchent, and prints from Italy; the better qualities of prints and flannels from Germany; while the Netherlands also has a share in the finer grades of prints. Austria-Hungary sells fine bleached goods and zephyrs, and Switzerland cheap prints and cottonades, called "materia."

CLASSES OF GOODS IN DEMAND.

The classes of goods sold in Servia do not differ materially from those imported by Roumania and Bulgaria. Prints are used in summer and barchent and cotton flannels in winter, while gray and bleached goods and, to a less extent, oxfords are in demand throughout the year. In the statistics goods are classed according to construction rather than finish or color. The bulk of the cloth imported consists of fabrics weighing more than 120 grams per square meter and having up to 80 threads per square centimeter and fabrics weigh-

ing from 60 to 120 grams per square meter and having from 50 to 80 threads per square centimeter. Most of the gray sheetings (generally called "Americana") sold are made up like T cloths, with a colored heading. Samples showing the principal headings used are furnished with this report. Merchants state, however, that the heading is not required and that the goods can be sold as readily without it.

There is no standard T cloth, but the most popular construction is 72 by 72 picks, 34 and 38 inches wide, put up in 48-yard lengths. The 34-inch is being bought at the present time (February, 1912) at 12s. 6d. (\$3.04) per piece and the 38-inch at 13s. 8d. (\$3.33). These are Liverpool prices, to which must be added freight and tariff charges amounting to nearly 45 per cent. Another construction is 72 by 56 picks and is made up in various widths—25, 30, 34, and 38 inches. The 25-inch is quoted at \$2.21, the 30-inch at \$2.45, and the 38-inch at \$2.88 per 48-yard piece. A still cheaper sheeting is 56 by 48 picks and 20 to 30 inches wide. This is put up in 24 folds containing 20 yards, the 20-inch being quoted at 55 cents per piece and the 24-inch at 68 cents f. o. b. Liverpool.

Some of the gray sheetings are sold here under the name "cabot" and come from Manchester and from Italy. An English sheeting sold under this brand is furnished in widths of 27 to 36 inches, 35 to 40 yards per piece. It is 48 by 48 picks, and the 27-inch width is sold at wholesale here for 45 centimes (8.68 cents) per yard. Nearly all of the gray goods are heavily filled. English sheeting has been on the market for a long time, is well known, and is sold through agents who are in close touch with the trade.

BLEACHED GOODS.

For a long time England also had a monopoly of the trade in bleached shirtings, but Austria-Hungary and Germany have recently become strong competitors, particularly in the finer grades. The term "madapollam" is used in Servia to designate a very wide variety of bleached goods and fine muslins. A very good seller along this line is 30 inches wide, 72 by 64 picks, with a stiff finish. It is put up in both narrow book fold and long fold, and the pieces usually contain either 30 to 40 yards or 30 meters. These goods are now being bought from England at 3½d. (7 cents) per yard f. o. b. Liverpool, while a cheaper quality is offered at 5 cents per yard. Both madapollam and the finer grades of bleached goods (called chiffon) are sold in various widths, but the 30, 32, and 36 inch are the most common. They are usually put up neatly and attractively, with two bands and with gilt lettering on the outside fold. Each piece comes wrapped in tissue paper with a heavy black glazed paper on the outside. They are packed in bales, ordinarily of 100 to 200 pieces.

There is a fairly good demand for wide bleached sheetings, or dowlahs, which come chiefly from Italy and Germany. The most popular construction is 56 by 48 picks, 150 centimeters (59 inches) wide, which is quoted at 90 centimes per meter (15.87 cents per yard) c. i. f. Belgrade. The goods also come in widths of 160, 180, 200, and 220 centimeters, or 63, 70.86, 78.74, and 85.6 inches. Tanjibs come mostly from England. They are always in 20-yard pieces, with three narrow stripes in gilt or red as a heading in the middle. The

usual construction is 48 by 48 or 56 by 56 picks, 39 to 40 inches wide, and they are quoted at 5 and 6 cents per yard in Liverpool.

COLORED GOODS.

Prints constitute the chief colored goods imports, and though all of the competing nations share in the trade England furnishes most of the cheaper qualities, which are the most widely sold. Switzerland and Italy also compete in this line, while Germany, Austria-Hungary, and the Netherlands furnish the better grades. Samples showing the most popular patterns, with prices, are furnished with this report. The tendency is toward the darker colors with little white showing, and dark blues and reds with small white dots or designs are very much in demand. Prints are always put up long fold, but they are folded three times before tacking. There is no standard length, but most of the pieces contain 34 to 40 yards; the cheaper grades are rather stiffly finished. While 28-inch prints are most common, the 30-inch width is also sold. The prices at which they are now bought vary from 3 cents per yard for the lower qualities to 7, 8, and 10 cents for the finer grades. Samples that are forwarded will give a clear idea of the range of qualities used.

Flannels and barchent are second in importance to prints. The better grades come from Germany and England, while Italy supplies the cheaper qualities. The former are usually 70 centimeters (27.56 inches) wide and the latter from 57 to 58 centimeters (22.44 to 22.83 inches). The prices range from 38 to 45 centimes per meter (6.7 to 7.93 cents per yard) for the cheaper qualities to 50 to 80 centimes per meter (8.82 to 14.11 cents per yard) for the finer grades c. i. f. Belgrade. Barchent is also made in one of the native mills. There are 4 small weaving establishments in Servia, containing about 800 looms. The product is mainly coarse gray and bleached goods, but recently colored goods, stripes, oxfords, and barchent have been woven. The latter, of course, is made with dyed yarn, as there are no printing works in the country.

Oxfords and vichy cloths (fine ginghams) are also sold here, England, Austria-Hungary, and Germany sharing in the trade. Other cotton goods imported are piqué, nankeen, creton, reps, velvets and corduroy, linings, handkerchiefs, bed and table covers, ready-made clothing, and underclothing and knit goods (mainly from Germany). The trade in any one of these lines, however, is small, and the fabrics already mentioned (gray and bleached goods, prints, flannels, barchent, and oxfords) are the main classes of goods purchased abroad.

SELLING METHODS—CREDITS—TRANSPORTATION AND FREIGHT RATES.

Practically all of Servia's trade is centered in Belgrade, and the cotton-goods business is in the hands of less than a dozen large wholesale dealers there. These firms buy goods abroad and sell them through their own traveling men to small dealers throughout the country. All the principal manufacturers abroad have agents in Belgrade, who call frequently on the wholesalers and, in general, look after the business of their firms. In addition traveling men visit Belgrade twice each year, carrying a full line of samples. These

men make their trips well in advance of the season. Orders for fall goods are taken in December and January and for spring lines in June and July. German, Austrian, and Italian manufacturers usually quote prices c. i. f. Belgrade, while English quotations are usually f. o. b. Liverpool. A commission man in England usually packs and loads the goods, pays the freight from the mill to Liverpool, and extends 6 months' credit to the buyer. For his services he charges from $6\frac{1}{2}$ to 7 per cent commission. Germans and Austrians give 6 months' credit, while Italian manufacturers not infrequently give 9 and 12.

Servia has no seaport, but more than half of the imports are brought down the Danube from Austria-Hungary and Germany. English goods usually come by way of Trieste or Fiume, and the present freight rate from Liverpool to Belgrade by this route is 8.50 francs per 100 kilos (\$0.744 per 100 pounds). Nearly half of this rate (4.20 francs) covers the freight from Fiume by rail to Belgrade. As the freight rate from New York to Fiume or Trieste is only about 27s. (\$6.57) per ton of 40 cubic feet, American manufacturers can land goods in Belgrade as cheaply as the English. Nor is there any great difference in the time of passage. The Austro-Americana line has weekly sailings from New York to Trieste and Fiume, while the Cunard line has two or three per month, with an average time of passage of 17 days. There is no great delay in transshipment, and goods should arrive here in from 5 to 6 weeks. Through bills of lading are issued to Belgrade.

CUSTOMS TARIFF.

Servia imposes a higher tariff on cotton goods than any other non-manufacturing country in the world, the duties averaging from 35 to 40 per cent. The rates are specific and are levied on the net weight, which is determined by deducting from the gross weight an arbitrary tare allowance fixed by law, amounting in the case of cotton goods to 18 kilos (39.7 pounds) for cases and 3 kilos (6.6 pounds) for bales per 100 kilos (220.46 pounds) of gross weight. The United States enjoys the most-favored-nation treatment in the tariff. Following are the conventional rates on the yarn and cloth most widely sold on this market:

Articles.	Rate of duty per 100 kilos.	Rate of duty per 100 pounds.
Yarn, single:		
No. 1 to No. 24—	<i>Dinars.</i>	
Unbleached.....	25	\$2. 19
Bleached.....	30	2. 63
Dyed or printed.....	35	3. 07
No. 24 to No. 30—		
Unbleached.....	35	3. 07
Bleached.....	40	3. 50
Dyed or printed.....	45	3. 94
Above No. 30—		
Unbleached.....	40	3. 50
Bleached.....	45	3. 94
Dyed or printed.....	50	4. 38
Sewing and embroidery thread:		
Unbleached.....	50	4. 38
Bleached.....	55	4. 82
Dyed or printed.....	60	5. 25

Articles.	Rate of duty per 100 kilos.	Rate of duty per 100 pounds.
Fabrics:		
Weighing more than 120 grams per square meter (3.54 ounces per square yard) and having in warp and weft in one square centimeter (0.155 square inch)—	<i>Dinars.</i>	
Up to 50 threads.....	80	\$7.00
From 50 to 80 threads.....	100	8.73
More than 80 threads.....	130	11.38
Weighing from 60 to 120 grams per square meter (1.77 to 3.54 ounces per square yard) and having in warp and weft in one square centimeter—		
Up to 50 threads.....	130	11.38
From 50 to 80 threads.....	130	11.38
More than 80 threads.....	190	16.63
Weighing up to 60 grams per square meter (1.77 ounces per square yard) and having in warp and weft in one square centimeter—		
Up to 50 threads.....	190	16.63
From 50 to 80 threads.....	220	19.25
More than 80 threads.....	250	21.88
Handkerchiefs and shawls.....	120	10.50
Velvet and plush.....	170	14.88

NO AMERICAN COTTON GOODS ON THE MARKET.

No American cotton goods are on this market, and dealers stated that no attempt had ever been made to sell them. It is the opinion of the leading dealers that they can be sold, judging by the samples and prices of American cotton cloths that were shown them. To enter this market it is absolutely necessary to extend the same terms of credit (six months) that are offered by competing nations. It is impossible to do business on any other basis; in fact, the head of one firm stated that even if goods were offered at a slightly lower price for cash they would not attract the importers, because the latter are obliged to give long terms to customers in the retail trade.

While it is not advisable to extend credit promiscuously in Serbia, there are certain firms which are not only able to meet their obligations, but which also enjoy the highest reputation for commercial integrity. With these men it is a matter of business, pure and simple. They say they are unwilling to advance cash for goods which are nearly two months en route and which they themselves must sell on terms of 6, 8, and even 12 months. Allowing for a reasonable period of time that they hold the goods before selling, importers state that it averages at least 12 months before they get any return on their investment. Unless American manufacturers are willing to meet conditions as they exist here, it is doubtful if any appreciable amount of business can be done.

If a native agent were on the ground to represent the manufacturer and look after his interests in general the demand for credit could doubtless be met easily. The name of a capable man desiring to represent American manufacturers of cotton goods is transmitted with this report [and may be obtained from the Bureau of Manufactures]. However, a traveling representative should visit Belgrade once or twice each year with a full line of samples. He could easily visit the chief commercial centers in Bulgaria, Roumania, Serbia, Greece, and Turkey in one trip. Prices should be quoted c. i. f. Belgrade if possible, or c. i. f. Trieste or Fiume. The merchants here have no conception of what quotations f. o. b. New York mean, and it is very difficult to ascertain transportation charges from this side. It would

also be an advantage to quote prices in francs per meter. While the bulk of the cloth comes in yard folds and is sold by England by the yard, the merchant sells by the meter, and it is more or less confusing to him to convert yards and cents to meters and centimes. Competition is rather keen in all lines, and everything possible should be done to make American goods attractive to the buyer. Quotations made in the method mentioned would undoubtedly be a strong factor in securing trade.

COMPLAINTS AS TO AMERICAN METHODS.

Indifference of American manufacturers to inquiries and to the development of their trade in Servia has caused some complaint here. One man, after writing a manufacturer of typewriters and securing prices, sent a remittance to cover the cost of a sample machine, with the intention of taking the agency for it in Servia. It was nine months before the typewriter reached him, the manufacturer's excuse for the delay being that the manager of the export department had been on a vacation. Another man stated that he had ordered an oil engine, sending cash in advance. The order was referred to an agent in London, who turned it over to another agent in Hamburg. The latter sent it on to an agent in Vienna, who in turn forwarded it to an agent in Budapest. It was more than four months before the order was filled. Other persons spoke of having ordered and received catalogues and prices of American goods which were accompanied by a letter expressing the hope that "we may receive a favorable reply;" but when the "favorable reply" was forwarded and an order placed the American manufacturer wrote that "we do not care to do business in Servia."

SUMMARY OF OPPORTUNITIES.

It is a hopeful sign that, in spite of rebuffs and discouragements, the people in the Balkan States are anxious to handle American goods because of the splendid reputation they enjoy. The markets of Roumania, Bulgaria, and Servia are alike in this respect. The merchants are eager to represent and to sell things American. The total annual imports of these three countries amount to \$125,000,000, and the share of the United States is little more than \$1,000,000. The articles purchased abroad are mainly manufactured goods which the United States is in a position to furnish. The splendid reputation that American products enjoy more than any other factor has enabled us to secure the share of the trade we now have. As regards freight rates, American exporters are at no great disadvantage as compared with England, which annually exports to the Balkan States goods valued at nearly \$20,000,000, and whose trade is steadily increasing.

If a serious and determined effort to capture a share of the trade were made, backed by American selling methods and American advertising, the results would no doubt be satisfactory. It would be a splendid move to establish a commercial museum in each of the capitals—Bucharest, Belgrade, and Sofia—with competent men in charge. American goods of all kind could be displayed and orders taken direct by the manager. If a number of firms interested in securing trade were to cooperate in the undertaking the ex-

pense to each manufacturer would not be considerable and good results would undoubtedly follow. Other nations have established such institutions and the returns have been very gratifying. The desire of the people to know more about American goods could be much better satisfied by having samples on display with a man on the spot to demonstrate their good qualities than by sending out catalogues in English, which have no value here aside from an artistic standpoint because they are printed in a language that is no more understood here than the Turkish language is in New York. Although the markets in the Balkans have apparently been neglected by American manufacturers, the present is a most opportune time to enter the field and institute an aggressive campaign for a larger share of the trade.

LISTS OF SAMPLES.

ROUMANIA.

Sample 1.—Nankeen; made in Roumania; 31/32 inches wide; 56 by 56 picks; length of piece, 30 to 35 meters (32.8 to 38.3 yards); put up book fold; 3.25 yards per pound; wholesale price, 12.9 to 13.5 cents per meter (11.81 to 12.34 cents per yard).

Sample 2.—Cottonade, called materla in Roumania; made in Switzerland; 18/19 inches wide; 7.75 yards per pound; length of piece, 50 meters (54.7 yards); wholesale price, 8.29 to 8.68 cents per meter (7.58 to 7.93 cents per yard).

Sample 3.—Flannelet; imported from Austria; 26/27 inches wide; 3 yards per pound; length of piece, 35 to 38 meters (38.3 to 41.5 yards); wholesale price, 16.59 to 17.56 cents per meter (15.17 to 16.05 cents per yard).

Sample 4.—Barchent; imported from Italy; 21/22 inches wide; three-leaf twill; 6.25 yards per pound; length of piece, 40 to 45 meters (43.7 to 49.2 yards); wholesale price, 8.49 to 8.87 cents per meter (7.76 to 8.11 cents per yard).

Sample 5.—Barchent; imported from Italy; 27/28 inches wide; 5 yards per pound; length of piece, 40 to 45 meters (43.7 to 49.2 yards); wholesale price, 11 to 11.58 cents per meter (10.05 to 10.58 cents per yard).

Sample 6.—Piqué; imported from Austria; 27/28 inches wide; 3.7 yards per pound; length of piece, 30 to 35 meters (32.8 to 38.3 yards); wholesale price, 16.4 to 17.37 cents per meter (14.99 to 15.87 cents per yard).

Sample 7.—Oxford; made in Roumania; 26/27 inches wide; 4.75 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); wholesale price, 8.87 to 9.26 cents per meter (8.11 to 8.46 cents per yard).

Sample 8.—Print or calico; imported from England; 27/28 inches wide; 7 yards per pound; length of piece, 40 meters (43.7 yards); wholesale price, 8.49 to 8.87 cents per meter (7.76 to 8.11 cents per yard).

Sample 9.—Print or calico; imported from Austria; 27/28 inches wide; 7.5 yards per pound; length of piece, 40 to 45 meters (43.7 to 49.2 yards); wholesale price, 9.45 to 10.03 cents per meter (8.64 to 9.17 cents per yard).

Sample 10.—Print or calico; imported from Austria; 30/31 inches wide; 5.85 yards per pound; length of piece, 40 meters (43.7 yards); wholesale price, 12.54 to 13.12 cents per meter (11.46 to 11.99 cents per yard).

Sample 11.—Madapollam; imported from England; 40/41 inches wide; 56 by 40 picks; 3.7 yards per pound; length of piece, 40 yards exactly; price per piece, \$3.03 to \$3.18; wholesale price, 7.57 to 7.95 cents per yard.

Sample 12.—Madapollam; imported from England; 29/30 inches wide; 64 by 64 picks; 7 yards per pound; length of piece, 40 yards exactly; price per piece, \$2.65 to \$2.75; wholesale price, 6.62 to 6.85 cents per yard.

Sample 13.—Croydon; imported from England; 38/39 inches wide; 52 by 60 picks; 3.75 yards per pound; length of piece, exactly 22 meters (24 yards); price per piece, \$2.70 to \$2.84; wholesale price, 12.28 to 12.91 cents per meter (11.21 to 11.81 cents per yard).

Sample 14.—Croydon; made in Roumania; 32/33 inches wide; 56 by 56 picks; 3.85 yards per pound; length of piece, exactly 22 meters (24 yards); price per piece, \$2.84 to \$2.99; wholesale price, 12.9 to 13.27 cents per meter (11.81 to 12.13 cents per yard).

Sample 15.—Croydon; made in Roumania; 33/34 inches wide; 56 by 56 picks; 4.25 yards per pound; length of piece, exactly 22 meters (24 yards); price per piece, \$2.46 to \$2.60; price per meter, 11.18 to 11.81 cents (10.23 to 20.78 cents per yard).

Sample 16.—Chiffon; made in Roumania; 31/32 inches wide; 76 by 76 picks; 7.5 yards per pound; length of piece, exactly 30 meters (32.8 yards); price per piece, \$3.08 to \$3.23; price per meter, 10.26 to 10.76 cents (9.38 to 9.84 cents per yard).

Sample 17.—Chiffon; made in Roumania; 29/30 inches wide; 76 by 60 picks; 6 yards per pound; length of piece, exactly 30 meters (32.8 yards); price per piece, \$2.56 to \$2.70; price per meter, 8.53 to 9 cents (7.79 to 8.12 cents per yard).

Sample 18.—Chiffon; made in Roumania; 31/32 inches wide; 80 by 80 picks; 4.55 yards per pound; length of piece, exactly 30 meters (32.8 yards); price per piece, \$3.57 to \$3.76; price per meter, 11.9 to 12.53 cents (10.76 to 11.44 cents per yard).

Sample 19.—Long cloth; made in Roumania; 29/30 inches wide; 52 by 52 picks; 7.55 yards per pound; length of piece, exactly 33 meters (36 yards); price per piece, \$2.31 to \$2.41; price per meter, 7 to 7.3 cents (6.3 to 6.54 cents per yard).

Sample 20.—Long cloth; made in Roumania; 32/33 inches wide; 56 by 52 picks; 4.75 yards per pound; length of piece, exactly 33 meters (36 yards); price per piece, \$2.84 to \$2.99; price per meter, 8.6 to 9.06 cents (7.86 to 8.12 cents per yard).

Sample 21.—Long cloth; made in Roumania; 35/36 inches wide; 56 by 52 picks; 4.25 yards per pound; length of piece, exactly 33 meters (36 yards); price per piece, \$2.99 to \$3.13; price per meter, 9.06 to 9.48 cents (8.12 to 8.65 cents per yard).

Sample 22.—Long cloth; made in Roumania; 31/32 inches wide; 56 by 60 picks; 4 yards per pound; length of piece, exactly 33 meters (36 yards); price per piece, \$3.13 to \$3.28; price per meter, 9.48 to 9.93 cents (8.65 to 9.08 cents per yard).

Sample 23.—Long cloth; made in Roumania; 37/38 inches wide; 60 by 60 picks; 3.1 yards per pound; length of piece, exactly 33 meters (36 yards); price per piece, \$3.76 to \$3.95; price per meter, 11.39 to 11.93 cents (10.41 to 10.89 cents per yard).

Sample 24.—Heavy duck (called elken in Roumania); 25/26 inches wide; 28 by 32 picks; 3.6 yards per pound; drawn in two in an eye in the reed; length of piece, 35 to 40 meters (38.3 to 43.7 yards); price, 9.84 to 10.22 cents per meter (8.99 to 9.35 cents per yard).

Sample 25.—Zephyr; imported from England; 29/30 inches wide; 5.67 yards per pound; length of piece, 30 to 35 meters (32.8 to 38.3 yards); price, 10.42 to 11 cents per meter (9.53 to 10.05 cents per yard).

Sample 26.—Zephyr; imported from Austria-Hungary; 30/31 inches wide; 5.5 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); price, 8.91 to 9.87 cents per meter (8.14 to 9.03 cents per yard).

Sample 27.—Zephyr; imported from Austria-Hungary; 27/28 inches wide; 7.53 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); wholesale price, 12.16 to 12.93 cents per meter (11.11 to 11.81 cents per yard).

Sample 28.—Batiste; imported from England; 30/31 inches wide; 6.69 yards per pound; length of piece, 20 to 22 meters (21.9 to 24 yards); wholesale price, 9.84 to 10.42 cents per meter (9 to 9.53 cents per yard).

Sample 29.—Batiste; imported from England; 25/26 inches wide; 10.12 yards per pound; length of piece, 40 to 45 meters (43.7 to 49.2 yards); wholesale price, 7.14 to 7.52 cents per meter (6.52 to 6.88 cents per yard).

Sample 30.—Print or calico, with fancy border; 29/30 inches wide; 6.5 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); wholesale price, 11.96 to 12.54 cents per meter (10.93 to 11.46 cents per yard).

Sample 31.—Printed cashmere; imported from Spain; 26/27 inches wide; 7 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); wholesale price, 7.33 to 7.72 cents per meter (6.7 to 7.05 cents per yard).

Sample 32.—Flannelet (called velour in Roumania); imported from Italy; 27/28 inches wide; 3.95 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); wholesale price, 13.31 to 14.9 cents per meter (12.17 to 12.87 cents per yard).

Sample 33.—Flannelet (velour); imported from Germany; 27/28 inches wide; 4.32 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); wholesale price, 16.4 to 17.17 cents per meter (14.99 to 15.7 cents per yard).

Sample 34.—Flannelet (velour); imported from Germany; 27/28 inches wide; 3.96 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); wholesale price, 13.7 to 14.47 cents per meter (12.52 to 13.22 cents per yard).

Sample 35.—Flannelet (velour); imported from Austria-Hungary; 27.5 to 28.3 inches wide; 3.34 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); wholesale price, 19.3 to 20.2 cents per meter (17.6 to 18.48 cents per yard).

Sample 36.—Barchent; imported from Austria-Hungary; 27/28 inches wide; 3.6 yards per pound; length of piece, 35 to 40 meters (38.3 to 43.7 yards); wholesale price, 14.66 to 15.63 cents per meter (13.4 to 14.29 cents per yard).

Sample 37.—Nankeen; made in Roumania; 31/32 inches wide; 3.66 yards per pound; length of piece, 30 to 35 meters (32.8 to 38.3 yards); wholesale price, 13.51 to 14.00 cents per meter (12.34 to 12.87 cents per yard).

Sample 38.—Colored domestic; imported from the Netherlands; 27/28 inches wide; 2.98 yards per pound; length of piece, 45 to 50 meters (49.2 to 54.7 yards); wholesale price, 13.51 to 14.28 cents per meter (12.34 to 13.05 cents per yard).

Sample 39.—Sateen; imported from England; 38/30 inches wide; 4.73 yards per pound; length of piece, 40 to 42 meters (43.7 to 45.9 yards); wholesale price, 12.16 to 12.74 cents per meter (11.11 to 11.64 cents per yard).

Sample 40.—Printed sateen; imported from Austria-Hungary; 28.68 to 29.47 inches wide; 6.5 yards per pound; length of piece, 35 to 45 meters (38.3 to 49.2 yards); wholesale price, 13.51 to 14.28 cents per meter (12.34 to 13.05 cents per yard).

Sample 41.—Colored cambric; imported from England; 34.58 to 35.37 inches wide; 6.81 yards per pound; length of piece, 35 to 42 meters (38.3 to 45.9 yards); wholesale price, 8.68 to 9.07 cents per meter (7.93 to 8.28 cents per yard).

Sample 42.—Handkerchief; imported from England, size, 14.5 by 14 inches; weight, 0.56 ounce each; price per dozen, 24.7 to 26.05 cents.

Sample 43.—Head shawl; imported from Switzerland; size, 29.6 by 30.4 inches; weight, 2.04 ounces each; price per dozen, \$1.25 to \$1.31.

Sample 44.—Head shawl; imported from Switzerland; size, 29.6 by 30.4 inches; weight, 2.61 ounces each; price per dozen, \$1.33 to \$1.41.

Sample 45.—Head shawl; imported from Austria-Hungary; size, 28.3 by 28.68 inches; weight, 2.01 ounces each; price per dozen, \$1.15 to \$1.23.

BULGARIA.

Sample 1.—Gray sheeting (called "Americana" in Bulgaria); made in Bulgaria; 46 inches wide; 56 by 56 picks; retail price, 75 centimes per meter (13.22 cents per yard).

Sample 2.—Gray four-leaf twill (called "Americana"); made in Bulgaria; 29 inches wide; 64 by 64 picks; retail price, 65 centimes per meter (11.46 cents per yard).

Sample 3.—Bleached sheeting; made in Bulgaria; 32 inches wide; 64 by 64 picks; retail price, 65 centimes per meter (11.46 cents per yard).

Sample 4.—Bleached sheeting; imported from Austria-Hungary; 56 by 48 picks; retail prices, 82 centimeters (32.28 inches) wide, 80 centimes per meter (14.11 cents per yard); 90 centimeters (35.43 inches) wide, 87 centimes per meter (15.34 cents per yard); 100 centimeters (39.37 inches) wide, 1 franc per meter (17.6 cents per yard); 145 centimeters (57.09 inches) wide, 1.45 francs per meter (25.53 cents per yard); 200 centimeters (78.74 inches) wide, 2.2 francs per meter (38.83 cents per yard); 230 centimeters (90.55 inches) wide, 2.50 francs per meter (44.32 cents per yard).

Sample 5.—Cotton flannel; imported from Austria-Hungary; 28/29 inches wide; retail price, 1.20 francs per meter (21.13 cents per yard).

Sample 6.—Barchent; imported from Austria-Hungary; 27 inches wide; retail price, 1.40 francs per meter (24.65 cents per yard).

Sample 7.—Barchent; imported from Italy; 26 inches wide; retail price, 1 franc per meter (17.6 cents per yard).

Sample 8.—Barchent; imported from Austria-Hungary; 27 inches wide; retail price, 80 centimes per meter (14.11 cents per yard).

Sample 9.—Barchent; imported from Italy; 28/29 inches wide; retail price, 95 centimes per meter (16.75 cents per yard).

Sample 10.—Barchent; imported from Austria-Hungary; 30 inches wide; retail price, 1.10 franc per meter (19.36 cents per yard).

Sample 11.—Print; imported from Germany; 30 inches wide; retail price, 80 centimes per meter (14.11 cents per yard).

Sample 12.—Print; imported from England; 30 inches wide; retail price, 55 centimes per meter (9.7 cents per yard).

Sample 13.—Print for women's skirts; imported from Austria-Hungary; 34/35 inches wide; retail price, 80 centimes per meter (14.11 cents per yard).

Sample 14.—Blue twill goods; imported from Austria-Hungary; 34/35 inches wide; retail price, 1 franc per meter (17.6 cents per yard).

Sample 15.—Fine zephyr; imported from England; 32 inches wide; retail price, 1 franc per meter (17.6 cents per yard).

Sample 16.—Oxford; imported from England; 27 inches wide; retail price, 65 centimes per meter (11.46 cents per yard).

Sample 17.—Oxford; imported from Austria-Hungary; 30 inches wide; retail price, 90 centimes per meter (15.87 cents per yard).

Sample 18.—Fancy piqué, napped on one side; imported from Germany; 30/31 inches wide; retail price, 1.75 francs per meter (30.82 cents per yard).

Sample 19.—Fancy piqué, napped on one side; imported from Austria-Hungary; 26 inches wide; retail price, 1 franc per meter (17.6 cents per yard).

Sample 20.—Cretonne; imported from England; 50 inches wide; retail price, 1.70 francs per meter (29.94 cents per yard).

Sample 21.—Fancy colored twill; imported from Austria-Hungary; 31/32 inches wide; retail price, 75 centimes per meter (13.22 cents per yard).

Sample 22.—Satin; imported from Austria-Hungary; 60 inches wide; retail price, 2.60 francs per meter (45.88 cents per yard).

Sample 23.—Colored twill; imported from Austria-Hungary; 32 inches wide; retail price, 1 franc per meter (17.6 cents per yard).

Sample 24.—Furniture cloth; imported from Austria-Hungary; retail prices: 80 centimeters (31.5 inches) wide, 1 franc per meter (17.6 cents per yard); 90 centimeters (35.43 inches) wide, 1.2 francs per meter (21.13 cents per yard); 100 centimeters (39.37 inches) wide, 1.35 francs per meter (23.77 cents per yard); 110 centimeters (43.3 inches) wide, 1.50 francs per meter (26.42 cents per yard); 120 centimeters (47.24 inches) wide, 1.70 francs per meter (29.94 cents per yard).

Sample 25.—Fancy sateen ticking; imported from Austria-Hungary; 48 inches wide; retail price, 2.40 francs per meter (42.35 cents per yard).

SERVIA.

Sample 1.—T cloth; from England; 72 by 56 picks; 48 yards per piece; prices f. o. b. Liverpool: 25 inches wide, \$2.21 per piece; 30 inches wide, \$2.45; 33 inches wide, \$2.88.

Sample 2.—T cloth; from England; 72 by 72 picks; 48 yards per piece; prices per piece f. o. b. Liverpool: 34 inches wide, \$3.04; 38 inches wide, \$3.32; also made in 25 and 30 inch widths; this is the most common sheeting on the market.

Sample 3.—T cloth; from England; 56 by 48 picks; 20 yards in 24 folds per piece; prices per piece f. o. b. Liverpool: 20 inches wide, 55 cents; 24 inches wide, 68 cents; also made 22, 26, 28, and 30 inches wide.

Sample 4.—Sheeting; from England; 52 by 40 picks; 20 yards per piece; prices per piece f. o. b. Liverpool: 20 inches wide, 51 cents plus 6 per cent; 24 inches wide, 60 cents plus 6 per cent.

Sample 5.—Madapollam; from England; 40 yards per piece; long fold; 30 inches wide; price f. o. b. Liverpool, 7 cents per yard.

Sample 6.—Madapollam; from England; 30 meters (32.8 yards) per piece; book fold; 90 centimeters (35.43 inches) wide; price per piece f. o. b. Liverpool, \$2.52.

Sample 7.—Bleached shirting; from England; 30 meters (32.8 yards) per piece; 30 inches wide; price per piece f. o. b. Liverpool, \$1.28.

Sample 8.—Dowlah; imported from Italy; length of piece, 30 to 40 meters (32.8 to 43.7 yards); furnished in widths of 150, 155, 160, 180, 200, 220 centimeters; most popular width is 150 centimeters (59 inches) and is sold by Italian manufacturers at 90 centimes per meter (15.87 cents per yard) c. i. f. Belgrade.

Sample 9.—Print; imported from England; put up in pieces of 30 to 40 yards or meters; price c. i. f. Belgrade, 30 centimes per meter (5.29 cents per yard).

Sample 10.—Print; from England; 40 yards per piece; price, 4.75 cents per yard f. o. b. Liverpool.

Sample 11.—Print; from Germany; price, 5.8 cents per meter (5.29 cents per yard) c. i. f. Belgrade.

Sample 12.—Print; from Switzerland; 80 centimeters (32 inches) wide; price, 7.72 cents per meter (7.05 cents per yard).

Sample 13.—Print; from England; price, 5.74 cents per yard f. o. b. Liverpool.

Sample 14.—Print; from Spain; price, 5.01 cents per meter (4.58 cents per yard) c. i. f. Trieste.

Sample 15.—Print; from the Netherlands; price, 8.29 cents per meter (7.58 cents per yard) c. i. f. Belgrade.

Sample 16.—Print; from the Netherlands; price, 6.17 cents per meter (5.64 cents per yard) c. i. f. Belgrade.

Sample 17.—Print; from England; price f. o. b. Liverpool, 4.37 cents per yard plus 6 per cent.

Sample 18.—Print; from Germany; price, 6.94 cents per meter (6.35 cents per yard) c. i. f. Belgrade.

Sample 19.—Print; from England; price per yard f. o. b. Liverpool, 6.5 cents plus 6 per cent.

Sample 20.—Oxford; from Germany; price 9.04 cents per meter (8.27 cents per yard) c. i. f. Belgrade.

Sample 21.—Oxford; from England; price, 6.36 cents per meter (5.82 cents per yard) c. i. f. Belgrade.

Sample 22.—Flannel; imported from Germany; this is the most popular quality sold here; it is put up in 30-meter (32.8-yard) pieces and is usually 30 or 27 inches wide; price, 13.51 cents per meter (12.34 cents per yard) c. i. f. Belgrade.

Pattern sheets showing the most popular designs of prints used in Servia.

Pattern sheet showing the most popular designs of flannels used in Servia.



DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 54

COTTON GOODS IN TURKEY

PART I

By

RALPH M. ODELL

Commercial Agent of the Department of Commerce and Labor

TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD



WASHINGTON
GOVERNMENT PRINTING OFFICE
1912

LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE AND LABOR,

Washington, July 13, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ended June 30, 1912, approved March 4, 1911, a report by Commercial Agent Ralph M. Odell, of this department, containing the result of his investigations of the trade in cotton goods in Turkey.

Respectfully,

BENJ. S. CABLE,

Acting Secretary.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL

DEPARTMENT OF COMMERCE AND LABOR,

BUREAU OF MANUFACTURES,

Washington, May 10, 1912.

SIR: I have the honor to submit herewith Part I of a report by Commercial Agent Ralph M. Odell on the cotton-goods trade of Turkey, embracing the results of his investigations in Constantinople and district. Mr. Odell is now engaged in further study of the Turkish market, but because of unusual conditions that make the present an opportune time for the introduction of American goods it is deemed advisable to present to American manufacturers and exporters the facts already ascertained.

Respectfully,

A. H. BALDWIN,

Chief of Bureau.

TO HON. CHARLES NAGEL,

Secretary of Commerce and Labor.

COTTON GOODS IN TURKEY: PART I.

GENERAL TRADE CONDITIONS.

European and Asiatic Turkey, with an area of 800,000 square miles and an estimated population of 25,000,000, offers a splendid field for the development of American trade. The radical changes wrought since the establishment of the constitution and the inauguration of the new régime in 1908 have been of far-reaching importance in the progress and development of the country. The reorganization of the army and the police has stopped internal disturbances, has rendered travel easier and safer, and has insured a greater degree of security to industrial pursuits and investments of foreign and native capital. The development of the rich natural resources of the Empire is increasing the buying power of the people and causing a substantial commercial expansion. The establishment by the Government of model farms, dairies, silkworm nurseries, schools of agriculture, and depots of agricultural machinery has stimulated the progress of the country along agricultural lines.

The latter activities are an important factor in the general development of the country, for, notwithstanding that its immense natural resources if properly exploited would secure the welfare and economic independence of the country, Turkey is essentially an agricultural state, and the industries of the country are at present of no considerable importance. It may be safely assumed, however, that industrial growth will follow in the wake of the general development of the country. The concessions granted for the building of railroads and the construction of public works, such as electric tramways and telephones in Constantinople, the improvement of the harbors, projects for irrigation and for the building of highways in the interior (heretofore sadly lacking in means of communication), improvements in the administration of the customs, the abolition of abuses formerly existing in governmental activities, a more careful and economical system of expenditures and appropriations, and a serious effort to reorganize the country's finances on a sound basis—these are some of the reforms that augur well for the prosperity and general welfare of the nation.

FOREIGN TRADE.

The result of all these activities is reflected in the foreign trade of the country. The imports during the fiscal year ended March 13, 1910, were valued at \$146,883,247, as compared with \$107,873,000 in 1900, and during the same period the exports increased from \$68,821,000 to \$80,073,168. Preliminary statistics for the fiscal year 1911 show imports valued at \$172,700,000 and exports valued at \$92,454,000.

The following table gives the value of the principal articles imported and exported in 1910, according to Turkish official returns:

Articles.	Value.	Articles.	Value.
IMPORTS.		EXPORTS.	
Textiles.....	\$55,494,179	Raw silk and cocoons.....	\$10,813,699
Sugar.....	13,399,792	Raisins.....	7,189,317
Metals and metal ware.....	8,348,363	Raw wool and mohair.....	5,749,531
Flour, wheat.....	7,970,061	Raw cotton.....	4,067,138
Rice.....	5,946,350	Hides and skins.....	3,640,478
Wheat.....	5,837,355	Cereals.....	3,725,361
Mineral oils.....	4,662,960	Valonia.....	3,631,243
Wood and wooden articles and furniture.....	4,072,751	Mineral ores.....	3,273,165
Coffee.....	3,463,105	Nuts.....	2,966,574
Machines and implements.....	3,439,478	Dried figs.....	2,784,738
Earthenware and glassware.....	3,005,685	Eggs.....	2,613,755
Vegetable oils.....	2,763,949	Turkish and Persian rugs.....	2,362,399
Paper and paper goods.....	2,669,009	Opium.....	2,107,035
Animal food products.....	2,234,570	Live stock.....	2,028,783
Spirituous liquors and alcohol.....	2,047,371	Dates.....	1,851,263
Jewelry and precious stones.....	1,991,707	Olive oil.....	1,842,971
Fruits and vegetables.....	1,766,399	Wood and lumber.....	1,237,099
Sole leather.....	1,473,900	Soap.....	1,172,576
Corn.....	1,472,859	Coffee.....	1,065,545
Hides, raw.....	1,452,015	Oranges, lemons, and citrons.....	1,041,311
Paints and colors.....	1,412,640	Olives, black.....	1,027,578
Barley.....	1,246,714	Beans.....	961,609
Fuel.....	1,171,619	Silk goods.....	857,497
Chemicals and dyes.....	1,089,195	Vegetable and flower seeds.....	847,676
Medicines and drugs.....	1,013,942	Salted fish, in barrels.....	785,788
Live stock.....	974,103	Canned goods and preserves.....	638,613
Canned and preserved goods.....	859,027	Fuel.....	773,355
Rubber and rubber goods.....	625,809	Resin, tar, and glue.....	416,435
Tea.....	579,027	All other articles.....	8,560,323
Kid leather.....	360,383		
Morocco leather.....	432,305		
Boots and shoes.....	203,160		
All other articles.....	3,273,350		
Total.....	146,883,247	Total.....	80,073,196

The foregoing table includes only articles that are subject to duty and does not include imports of tobacco valued at \$432,328, and miscellaneous articles valued at \$5,485,993. Wine valued at \$206,649, miscellaneous articles valued at \$145,443, and tobacco amounting to 69,973,398 pounds are not included in the exports as tabulated. While Turkish statistics are only fairly accurate, they are far more reliable than in former years.

DISTRIBUTION OF FOREIGN TRADE.

The share of the various nations in the trade during the fiscal year 1910, according to Turkish figures, was as follows:

Countries.	Imports from.	Exports to.	Countries.	Imports from.	Exports to.
Austria-Hungary.....	\$27,672,867	\$7,650,559	Russia.....	\$11,049,009	\$2,861,661
Belgium.....	4,654,203	1,402,752	Servia.....	1,493,578	696,707
Bulgaria.....	5,242,749	3,281,922	Spain.....	265,899	157,016
Egypt.....	4,615,605	4,832,510	Switzerland.....	225,303	7,812
France.....	13,976,828	16,057,777	Tunis.....	117,415	26,125
Germany.....	9,715,712	4,926,830	United Kingdom.....	38,794,636	24,572,698
Greece.....	1,642,233	1,851,571	United States.....	2,259,588	3,067,635
Italy.....	13,242,072	5,394,219	All other countries.....	890,885	501,189
Netherlands.....	3,130,705	609,496			
Persia.....	2,881,087	299,158			
Roumania.....	5,012,873	1,786,461	Total.....	146,883,247	80,073,196

The United Kingdom ranks first in importance as a supplier of Turkish requirements, followed by Austria-Hungary, France, Italy, Russia, Germany, Bulgaria, Roumania, Belgium, Egypt, Netherlands, Persia, and the United States. The United Kingdom, France, Austria-Hungary, Italy, Germany, Egypt, Bulgaria, the United States, and Russia, in the order named, were the principal purchasers of Turkish products.

Great Britain ships principally cotton and woolen goods, coal, and coke; Austria, sugar, cotton and woolen goods, paper, clothing, ironware, glassware, lumber, and mineral oils; France, skins and furs, textiles, and sugar; Italy, cotton, woolen, and silk goods; Russia, sugar, petroleum, grain, and flour; Germany, iron and copper manufactures and textiles.

TRADE WITH THE UNITED STATES.

These statistics, however, are only fairly accurate, owing to the custom of crediting the imports to the country under whose flag the goods are shipped or from which they immediately come. The exports from Turkey to the United States were, in the calendar years 1909, 1910, and 1911, according to official consular returns, \$15,805,149, \$14,877,809, and \$19,929,629, respectively, thus putting the United States in second place in the export trade. American statistics show exports to Turkey in the calendar year 1910 valued at \$2,470,972, while for 1911 they amounted to \$4,396,901. The fact that in 1900 our exports to Turkey amounted to only \$622,233 and our imports from Turkey to but \$7,256,640 indicates the great expansion that has taken place in our trade with that country.

The following table, compiled from American statistics, gives the value of the principal imports from and exports to Turkey during the fiscal years ended June 30, 1910 and 1911:

Articles.	1910	1911	Articles.	1910	1911
IMPORTS.			EXPORTS.		
Chemicals, drugs, and dyes:			Agricultural implements.....	\$64,628	\$133,639
Gums.....	\$70,078	\$96,848	Cotton, manufactures of.....	272,310	335,327
Licorice root.....	628,120	1,200,813	India rubber, manufactures of.....	203,734	303,701
Opium, crude.....	1,278,235	1,606,919	Iron and steel, manufactures of.....	174,410	285,409
All other.....	215,927	273,012	Meat and dairy products.....	389,817	720,477
Coffee.....	175,811	200,826	Oils:		
Cotton, manufactures of.....	156,228	271,834	Vegetable—Cottonseed....	470,019	966,944
Emery ore.....	245,808	242,236	Mineral, refined.....	187,730	402,104
Fruits and nuts.....	1,548,287	2,425,000	All other.....	29,559	70,001
Hides and skins (except fur skins).....	1,482,034	723,327	All other articles.....	565,465	732,451
Oils.....	171,916	343,641	Total.....	2,357,672	3,940,053
Tobacco: Leaf.....	4,360,118	6,392,683			
Wool:					
Unmanufactured.....	1,811,307	1,135,814			
Manufactures — Carpets, etc.....	3,263,742	1,879,201			
All other articles.....	937,290	898,598			
Total.....	16,353,901	17,680,812			

Owing to the fact that many American articles are purchased from Hamburg, London, and other European houses, it is safe to assume that the value of all the goods imported from the United States is considerably more than that shown, and that our total trade with Turkey is only exceeded by that of the United Kingdom, Austria-Hungary, and France.

TEXTILE TRADE.

Textiles form 37 per cent of the total imports, and Turkey ranks third in importance among the cotton-goods markets of the world, coming after India and China. The various kinds of textiles imported during the Turkish fiscal year 1910 are shown in the following table:

Articles.	Value.	Articles.	Value.
Raw cotton and waste	\$87,834	Silkworm cocoons.	\$153,213
Cotton yarn and thread	6,070,516	Raw silk and silk yarn	443,194
All other cotton manufactures (including mixtures)	30,859,346	All other silk goods	1,454,961
Total	37,017,696	Total	2,051,278
Raw wool	174,218	Hats for men and women	187,684
Woolen yarn	379,029	Fezes (head gear)	917,710
Washed wool	11,695	Ready-made clothing for men, women, and children	890,823
Mohair	13,070	Oilcloth	372,223
All other woolen goods	9,800,663	Other textiles	286,285
Total	10,378,675	Total	2,654,825
Flax, hemp, and jute goods	3,391,706	Grand total	55,494,179

Woolen goods come from Austria-Hungary, United Kingdom, Germany, and France; silks from France, England, Italy, and Austria-Hungary; linen goods from the United Kingdom, Italy, Belgium, and Austria-Hungary. Jute sacks, used largely for grain, come chiefly from England.

COTTON-GOODS TRADE.

A fairly clear idea of the nature of the cotton-goods trade may be gained from the following table showing the quantity and value of the imports in the fiscal year 1910 and the value of the imports in 1909, according to Turkish statistics:

Articles.	1909	1910	
		Pounds.	Value.
Raw cotton.....	\$84,156	1,371,652	\$71,745
Cotton waste.....	19,605	108,717	16,089
Total.....	103,761	1,480,369	87,834
Yarn:			
Gray.....	3,345,430	18,595,412	3,043,624
Bleached.....	902,656	4,021,035	961,298
Colored.....	589,306	4,966,480	943,334
Thread.....	1,063,222	5,448,722	1,122,260
Total.....	5,900,614	33,031,649	6,070,516
Cloth:			
Gray.....	6,630,376	32,316,363	6,657,432
Bleached.....	3,819,642	15,675,293	3,975,251
Printed.....	7,722,722	41,632,261	12,354,659
Colored.....	1,685,896	6,233,748	1,707,703
Gauze, tulle, and muslin.....	378,825	587,004	257,865
Embroidered tissues, bed and table covers, and head shawls.....	201,184	488,006	274,682
Velvet.....	237,222	580,149	395,972
Shawls.....	44,535	151,921	63,744
Tissues for curtains.....	73,121	1,686,951	407,760
Handkerchiefs and napkins.....	360,494	1,035,736	463,122
Lace and passamenterie.....	566,342	1,011,727	598,272
Knit goods.....	944,525	6,640,227	1,321,550
Fabrics mixed with silk.....	884,691	1,019,623	867,820
Fabrics mixed with wool.....	868,979	3,527,011	1,513,414
Total.....	24,418,554	112,586,020	30,859,346
Grand total.....	30,422,929	147,068,038	37,017,696

Yarns constitute 16 per cent, and piece goods 66 per cent, of the total imports.

SHARE OF PRINCIPAL NATIONS IN COTTON-GOODS TRADE.

The share of the various nations in the Turkish cotton-goods trade in 1910 is shown by the following table:

Articles.	United Kingdom.	Italy.	Austria-Hungary.	Germany.	France.	United States.	All other countries.
Raw cotton.....	\$27,222	\$16,455	\$5,530	\$932	\$5,714	\$373	\$15,519
Cotton waste.....	5,521	4,480	4,413	303	417	.....	955
Total.....	32,743	20,935	9,943	1,235	6,131	373	16,474
Yarn:							
Gray.....	1,755,162	852,510	182,243	53,190	10,639	1,381	188,490
Bleached.....	725,293	150,488	53,000	13,460	3,507	.....	15,541
Colored.....	834,145	349,593	178,747	44,535	5,322	448	20,544
Sewing thread.....	526,834	154,581	181,266	116,929	10,509	.....	132,141
Total.....	3,341,434	1,507,181	595,265	228,114	29,977	1,829	366,716

Articles.	United Kingdom.	Italy.	Austria-Hungary.	Germany.	France.	United States.	All other countries.
Cloth:							
Gray.....	\$4,679,668	\$824,176	\$342,621	\$121,852	\$207,553	\$129,200	\$352,363
Bleached.....	3,479,206	151,280	141,998	37,255	63,466	8,074	93,972
Printed.....	6,149,489	3,220,992	921,267	698,689	550,783	9,865	803,444
Colored.....	534,273	481,807	244,529	116,302	125,593		205,190
Gauze, tulle, and muslin.....	210,845	5,847	8,952	13,491	14,000		4,440
Embroidered tissues, bed and table covers, and head shawls.....	94,668	25,676	75,016	4,423	4,670		70,529
Velvet.....	100,928	12,272	105,266	62,939	103,910		10,657
Shawls.....	36,393	2,672	16,178	5,432	2,889		180
Tissues for curtains.....	328,881	14,881	16,755	21,069	5,558		20,596
Handkerchiefs and napkins.....	280,291	56,611	68,894	26,168	12,194	7	18,357
Lace and passamenterie.....	141,592	73,847	162,654	138,508	50,228	1,102	30,341
Knit goods.....	96,541	191,678	514,013	322,260	110,594	1	86,463
Fabrics mixed with silk.....	116,966	278,933	111,272	70,940	235,941	1,437	52,331
Fabrics mixed with wool.....	535,412	249,360	234,350	305,229	126,814		62,249
Total.....	16,785,153	5,590,032	2,963,765	1,944,577	1,614,283	149,816	1,811,720
Grand total.....	20,159,330	7,118,148	6,568,973	2,173,926	1,650,391	152,018	2,194,910

The column "All other countries" includes imports from Belgium valued at \$619,906; Netherlands, \$616,264; Spain, \$223,264; and Russia, \$132,290.

The foregoing table shows that the United Kingdom dominates the cotton-goods trade, imports from Great Britain exceeding in value those from all other nations combined. But Continental competition has made serious inroads in its trade in recent years, and this is particularly true as regards Italy. Imports of cotton goods from Italy have increased from \$2,188,000 in 1900 to \$3,425,000 in 1906 and to more than \$7,000,000 in 1910. The present Italo-Turkish war has put a stop to this trade and the deficiency is being made up largely by increased purchases in England, Austria, Germany, and Spain.

TURKISH STATISTICS—TRADE OF ENGLAND.

Turkish statistics, although far more reliable than in former years, do not show the total value of the foreign trade. Many reforms have been instituted in the administration of the customs, and abuses that formerly existed have been corrected, but the practice of undervaluing goods and presenting false invoices has not yet been eliminated entirely. Official figures of countries exporting to Turkey show that the cotton-goods trade here amounted to more than \$45,000,000 in the fiscal year 1910, instead of \$37,000,000 as the Turkish customs statistics show. According to British returns the exports of cotton manufactures from the United Kingdom to Turkey were \$29,176,650 in 1906, \$25,405,967 in 1909, and \$26,096,878 in 1910, while the Turkish statistics for 1910 credit to England only \$20,159,330, which figure includes cotton and its manufactures. British statistics indicate that England is not holding its own in the Turkish cotton-goods trade, owing largely to the competition of cheap Italian goods. British exports of piece goods alone to Turkey amounted to \$26,358,314 in 1911, as compared with \$22,473,256 in the previous year, but it should be noted that in October, 1911, a prohibitive duty of 100 per cent was levied against Italian goods and the sales of British goods increased immediately.

In view of the importance of England's trade the following table (compiled from British statistics) showing the principal classes of cotton manufactures exported by England to Turkey during the calendar years 1909, 1910, and 1911 is given:

Articles.	1909	1910	1911
Unbleached yarn.....	\$1,477,502	\$833,811	\$1,116,364
Bleached and dyed yarn.....	1,070,147	1,031,634	1,008,650
Sewing thread.....	580,205	584,286	(¹)
Total.....	3,127,944	2,449,731	¹ 2,125,023
Piece goods:			
Gray.....	4,847,374	4,534,225	5,232,163
Bleached.....	5,070,357	5,784,005	6,554,445
Printed.....	6,526,502	6,922,576	8,073,065
Colored.....	4,878,956	5,232,450	6,498,621
Total.....	21,333,189	22,473,256	26,358,314
Hosiery.....	13,810	25,140	(¹)
Gauze and tulle.....	176,381	225,771	(¹)
All other manufactures.....	764,643	922,980	(¹)
Grand total.....	25,405,967	26,096,878	¹ 28,483,337

¹ Statistics for only yarn and piece goods available for 1911.

ITALY'S SHARE OF TRADE.

Italy's trade, according to its own official figures, amounted to \$5,814,704 in 1905, \$8,405,000 in 1909, \$10,017,845 in 1910, and \$9,723,016 in 1911. These figures show the growth of the trade in recent years, and the decline in 1911 may be directly attributed to the present war.

According to the Ministry of Finance of Italy, the exports of cotton goods to Turkey in 1910 and 1911 were as follows:

Articles.	1910	1911	Articles.	1910	1911
Yarn, single:			Fabrics—Continued.		
Gray.....	\$1,552,143	\$1,661,115	Colored.....	\$2,274,811	\$2,527,444
Bleached.....	144,267	150,760	Printed.....	3,648,750	2,796,777
Dyed.....	122,190	78,849	Figured goods and damask.....	275,370	473,213
Yarn, twisted:			Cotton goods mixed with wool.....	67,511	74,092
Unbleached.....	141,083	126,070	Knitted and sewn goods..	136,721	154,786
Bleached and colored.....	147,562	167,557			
Sewing thread.....	108,080	77,489	Total.....	7,802,520	7,459,176
Total.....	2,215,325	2,263,840	Grand total.....	10,017,845	9,723,016
Fabrics:					
Gray.....	1,260,183	1,302,478			
Bleached.....	130,174	140,386			

A point worthy of note in the foregoing is the preponderance of colored and printed goods, which constitute over 50 per cent of the total exports. In the several lines of printed flannels, barchent, vichy cloth (coarse gingham), and plaids and cheap cotton goods for trousering, Italian manufacturers have generally quoted prices so low that they could not be approached by other countries, which fact largely accounts for the trade Italy has enjoyed. It must always be borne in mind that the first and greatest consideration in the Turkish cotton-goods market is cheapness.

Taking the official figures of England and Italy, it is seen that the total exports of cotton goods from these countries to Turkey amounted to \$33,810,967 in 1909 and \$36,112,793 in 1910, as compared with Turkish figures showing \$27,277,478; moreover, Turkish statistics give the total cotton-goods imports from all nations as only \$37,017,696. Assuming that similar discrepancies exist in the statistics of trade with other countries it may be conservatively estimated that Turkey's purchases of cotton goods now aggregate over \$50,000,000 annually.

IMPORTS INTO VARIOUS DISTRICTS.

Constantinople is by far the most important market for cotton goods, while the Trebizond district imports the greatest amount of yarns. The following table shows the imports of yarn, cotton and cotton waste, thread, piece goods, and all other manufactures in the several customs districts of Turkey during the year ended March 13, 1910. The district designated as "dependencies" refers to the outlying districts around Constantinople:

Customs districts.	Cotton and cotton waste.	Yarn.	Thread.	Cloth.	All other articles.
Constantinople.....	\$36,338	\$554,864	\$435,954	\$8,593,370	\$2,814,059
Dependencies.....	163	292,993	11,234	428,865	35,574
Smyrna.....	7,966	606,709	246,922	3,318,047	970,888
Saloniki.....	19,455	304,915	235,131	2,475,056	1,056,346
Trebizond.....	2,763	1,160,407	21,098	1,897,765	154,782
Prevesa.....	6,520	155,619	3,871	527,542	77,903
Bagdad.....	4,320	111,293	18,709	1,664,726	233,907
Beirut.....	8,965	788,881	104,283	2,353,026	553,766
Alexandretta.....	113	769,674	31,110	2,095,016	146,514
Dedeagatch.....	288	69,880	1,362	251,417	35,143
Tripoli in Africa.....	78	64,696	7,529	241,345	27,064
Yemen.....		59,303		465,569	50,813
Jeddah.....	875	12	5,047	353,301	7,642
Total.....	87,834	4,948,256	1,122,260	24,695,045	6,164,301

The business in Constantinople is very largely in the hands of Armenians established in Stambul, many of whom maintain branch houses in Manchester; but the Germans, Austrians, and Italians have their own agents or commission men, who sell on commission to the large dealers. Constantinople being the chief commercial center of Turkey, is the headquarters for a large part of the Asia Minor trade. Orders for goods destined for Samsun, Trebizond, Harput, Diarbekr, and also for Persia are generally placed in Constantinople, although the mills often consign the goods direct to the customer. There are numerous houses in the Stambul section of the city that deal exclusively in cotton goods, and competition at all times is keen.

THE YARN TRADE.

The yarns sold in Turkey are mainly gray 12s, 14s, 16s, and 18s, and they are used in the native hand manufacture and in the rug-making industry, which is carried on extensively throughout the country.

Great Britain has long enjoyed a monopoly of the yarn trade in all varieties of qualities and sizes, gray and colored, single and ply. Italian manufacturers up to the time of the war had secured a

considerable yarn trade, particularly in coarse numbers, because, by using cheaper cottons than the English, they were able to quote lower prices. Since the elimination of Italian yarns, considerable business is being done by the Austrian spinners. India also has a good trade in coarse yarns, but as the imports from that country are included with those from Great Britain it is difficult to ascertain how much Indian yarn is being sold. Inquiries among the dealers, however, elicited the information that large quantities of the low numbers are bought in Bombay because of their cheapness, a factor which has great weight in all lines of trade in Turkey.

PRICES OF AUSTRIAN YARN—SEWING-THREAD TRADE.

The present prices of Austrian yarn c. i. f. Constantinople are as follows:

Yarns.	Price per 10-pound bundle.	Price per pound.	Yarns.	Price per 10-pound bundle.	Price per pound.
Single gray:	<i>Francs.</i>	<i>Cents.</i>	Single bleached:	<i>Francs.</i>	<i>Cents.</i>
4s.....	8.30	15.82	4s.....	9.30	17.95
6s.....	8.50	16.41	6s.....	9.50	18.34
8s.....	8.70	16.79	8s.....	9.70	18.72
10s.....	8.90	17.18	12s.....	10.00	19.80
12s.....	9.10	17.56	16s.....	10.80	20.84
14s.....	9.50	18.33	20s.....	11.30	21.81
16s.....	10.10	19.49	Gray twist:		
20s.....	10.30	19.88	16/2.....	11.10	21.42
22s.....	10.80	20.84	20/2.....	11.60	22.39
24s.....	11.00	21.23	40/2.....	14.20	27.41

Owing to the establishment of several native dye works during the past few years the importation of colored yarns is declining. All of the competing nations share in this trade, but the fancy colored and printed yarns come mostly from Germany.

There is a considerable demand for mercerized yarn, which is used by the Turks in making embroidered and ornamental cloths that are often sold as pure silk. Germany and Italy have had the bulk of this trade but England is also beginning to share in it. Numbers 20/2, 40/2, and 60/2 in both white and colored are sold, but the 20/2 in red is most popular. At present it is being offered by Austrians at 16.30 francs (\$3.15) per 10 pounds c. i. f. Constantinople.

Sewing thread is supplied chiefly by England, with smaller quantities from Austria-Hungary, Italy, Belgium, and Germany, in the order named. All yarn is put up in 10-pound bundles, usually with the same number of skeins in a bundle as the number of the yarn, except in the case of coarser counts, where half skeins are used. In a bundle of 12s, for instance, there are 24 half skeins, but in a bundle of 20s there are usually 20 full skeins each weighing 8 ounces. Ordinarily there are 40 bundles to the bale. England usually sells yarn on terms of cash on receipt of documents, but sometimes three months' credit from date of documents is allowed. England generally gives 3 per cent discount, but the other countries, particularly Italy, give 5 per cent. This discount, in theory, is given only on cash payments, but in practice it is always deducted and the importer takes advantage of the credit allowed.

PIECE GOODS.

The principal piece goods imported at Constantinople are prints, T cloth, gray and bleached sheetings and shirtings, flannels, barchent, oxfords, and toile de vichy, or coarse, yarn-dyed goods. Of the prints, about 50 per cent of the total and nearly all the cheaper qualities come from Manchester. Formerly England had 70 per cent of this trade, but here as in other lines the competition of the Italians, Germans, and Austrians has been effective. In gray goods Great Britain has a practical monopoly of the T-cloth trade, but Austria and Italy have a large share in the gray sheeting and drills, which are almost universally sold under the name of "cabots." The better grades of bleached muslin, madapollam, and similar fabrics are still an English specialty, Germany and Austria selling smaller quantities, while the cheaper grades come from Italy. Before the present war Italy was shipping large quantities of flannel and barchent, but Germany and France are now enjoying the bulk of this trade, with smaller quantities from England. Oxfords come mainly from England and vichy cloth from Austria-Hungary, Italy, Germany, and Spain. Spain's trade has increased since the outbreak of the war, and it is shipping a considerable quantity of both gray and colored goods to Turkey. Another new factor in the market is Egypt, which, from its one mill in Alexandria, is furnishing a gray cloth marked "cabot" at such a low price that it is very much in demand.

AMERICAN COTTON GOODS—CABOTS.

The exports of American cotton goods to Turkey have declined in recent years, and they amounted to only \$271,507 in the calendar year 1910, according to our own figures. More recently, however, there has been an increase, and in the fiscal year 1911 cotton manufactures to the value of \$335,327 were shipped to European and Asiatic Turkey. Of the latter, gray goods amounted to \$313,243, bleached goods \$3,227, colored goods \$6,916, knit goods \$2,283, clothing \$4,258, and all others \$5,400. These figures, however, include only the direct trade; a considerable amount of American cotton goods, in the opinion of importers, is purchased from English and German firms.

In a study of the cotton-goods trade in Turkey it is almost impossible to ignore the universal use of the word "cabot," and the story of how it came to be used forms an interesting chapter in the history of the trade. Originally the brand of a well-known American mill, it has come to be employed as a generic term for coarse sheetings and drills. The Turkish War Department, in advertising for proposals to furnish cotton goods for the army, specifies cabot just as it specifies khaki or flannel.

Some years ago the American Cabot brand, which is registered in Turkey, enjoyed such a large sale here that it led to many imitations by European manufacturers. The native Turk became familiar with the brand and he demanded it when he entered a store to buy goods. Of course he did not know English, but he learned to know the brand and its general appearance. At first the imitators stamped the word "Cadot" or "Cloth" on the outside fold, which was quite sufficient for the uneducated country folk. When they began to copy

the original, however, proceedings were instituted against several offenders by the American manufacturers, who won their case in court.

For a time the imitations ceased, but not for long, and to-day not only the word "Cabot" is used on the cloth but the entire brand is copied, including the flying eagle, the shield, and the well-known blue labels at the bottom, on which it is stated in four languages that the goods (always heavily sized) are made of pure cotton and that none is genuine without the label. In samples furnished with this report there are two pieces of so-called "cabot." Each piece is an imitation of the American goods and each has the blue label certifying that it is the genuine article. One prominent importer stated that often a supply of these labels was kept on hand and forwarded to the mill with each order, to be pasted on the goods. Sometimes the cloth is ordered without any brand, and the marks are put on here by the importers themselves. Manufacturers in one European country have recently gone even further by inserting under the outside fold a long sheet of brown paper, similar to that found in the original, with a printed warning to the customer to beware of imitations.

DIFFERENCES BETWEEN GENUINE AND IMITATION CABOTS.

The chief difference between these imitations and the American brand is that the former, while often heavier, have considerable more sizing and the quality is therefore much inferior. An equally important advantage in wresting the trade in these goods from the United States has been gained by the imitators in the manner of putting up the goods. The original brand is put up in 40-yard pieces with the figure "40" stamped at the bottom of the outside fold. This figure is important because without it the Turk does not believe it is the genuine article. The European manufacturers stamp "40" on the outside fold but put only 33 meters (36 yards) in a piece, with 40 folds or laps. The importer buys the goods by the yard and so also does the small dealer who buys from the importer and sells to the consumer. The dealer sells the goods by the piece (the pieces are tacked on each end with a red thread that prevents close examination) and he does not want 40 yards in them, because he can sell the 36-yard piece at the price of the 40-yard. Many of the goods are 1 or 2 inches narrower than the width under which sold, but as they are heavily filled the pieces may be even heavier than the genuine Cabot, which is full length and width. Such practices have practically driven the American gray goods off the market, and it will be difficult to regain the business except by meeting existing conditions and furnishing what the trade demands.

DESCRIPTION OF FOUR TYPICAL IMITATION CABOTS.

The goods classed as cabots come in a variety of widths, from 70 to 100 centimeters (27.56 to 39.37 inches), but the 85-centimeter (32.46-inch) enjoys the widest sale. Among the samples furnished with this report are four pieces of imitation cabots that are typical of the cloths sold here under this brand. The first has the eagle, shield, and the blue labels, in addition to the word "Cabot" and the figure "40" on the outside fold. It is 35½ inches wide, 60 by 60 picks,

weighs 2.5 yards per pound, and is quoted at 45 centimes per meter (7.93 cents per yard) c. i. f. Constantinople, and for each 5 centimeters difference in width there is a corresponding difference of 2 centimes per meter (0.353 cent per yard) in price. Another sample with the word "Cabot," the number "40," and the blue labels but with a lion instead of an eagle design at the top is 100 centimeters (39.37 inches) wide, 52 by 48 picks, weighs 2.75 yards per pound, and was sold prior to the outbreak of the war at 36 centimes per meter (6.39 cents per yard) c. i. f. Constantinople. The third sample has a heavy finish without the stiff wiry feel peculiar to the second sample described. This head end has the eagle brand and the number "40," but the blue labels are not used and instead of "Cabot" the word "Cloth" is stamped on the goods. It is 28 inches wide, 64 by 64 picks, weighs 3 yards per pound, and is sold at 3d. (6 cents) per yard f. o. b. port of shipment. The fourth sample is 34 inches wide, 52 by 52 picks, weighs 2.5 yards per pound, and is quoted at 38.5 centimes per meter (6.79 cents per yard) c. i. f. Constantinople. The first sample described has only 30 meters (32.75 yards) to the piece, while the second and third have 33 meters (36 yards); all are folded in 40 laps. The fourth sample is marked "40 yards" instead of merely "40," and the piece measured was found to contain the full number of yards. A somewhat better grade of these goods is used by the Government, some 10,000,000 meters being purchased annually by the War Department. It is 32 inches wide, 72 by 76 picks, 2.85 yards per pound, and is sold at about 6½ cents per yard c. i. f. Constantinople.

The T cloths sold in Turkey have about the same width and construction as the so-called cabots, being distinguished only by the colored woven head ends. They usually come in 24-yard lengths, weigh from 3 to 4.5 yards per pound, and are now selling at 4½ to 6½ cents per yard. A number of samples of these goods are furnished, showing not only the various qualities in demand but the most popular styles of head ends.

BLEACHED GOODS AND WHITE SHIRTINGS.

Bleached goods, such as shirtings, madapollam, muslin, and long cloth, are imported in considerable quantities for clothing, head coverings, veils, and other purposes; they are used largely to take the place of linen. For a long time England has had the bulk of this trade, because the finish given by British manufacturers is very much preferred and competing nations appear to have difficulty in imitating it. Turkish statistics for 1910 show that about 90 per cent of the total imports of bleached goods came from England. More recently Italy has had a fairly good trade in the cheaper qualities, while the Netherlands, France, Germany (Alsace-Lorraine), and Austria-Hungary are beginning to furnish the finer grades in competition with British goods. An idea of the finish desired in this market can be obtained from an examination of the sample furnished with this report. It is a soft linen finish with very little weight added, and is known in the trade as "Pilsworth," from the name of the firm that originated it. The private brand of this firm, a small rectangle with the figure of a beetle stamped in gilt in the center, is very well known and often demanded by the dealers.

Bleached goods come in a variety of widths from 30 to 98 inches, and from 48 by 56 up to 76 by 76 and 80 by 80 picks. The 30-inch width is usually put up in 24 and 40-yard pieces, the 34, 36, 38, 44, 48, and 52-inch widths in 36 to 40 yard pieces, and the wider goods in 19 to 20 yard lengths. The narrower styles generally come in book fold, though this is not required. The biggest demand is for the 36 and 38 inch shirtings, and what is considered the standard madapollam is 36 inches wide, 72 by 80 construction, and is selling at present (April, 1912) at 10½s. to 11s. (\$2.55 to \$2.68) per piece of 36 yards, c. i. f. Constantinople, with 5 per cent discount. This corresponds to 7.08 to 7.44 cents per yard.

DUCK AND DRILLS—DEMAND FOR REMNANTS.

The duck sold on the Constantinople market is 8, 10, 12, and 14 ounce, and it comes mainly from England, with a small quantity from the United States.

A fairly large quantity of drills is imported, but the demand is mainly for piece-dyed goods, blue being the most popular color. The United States has shared in this trade, but the bulk of it is held by Austria-Hungary and the Netherlands. There is a wide variety of widths and constructions. A sample of the lighter weight sold is furnished with this report. It is 66 centimeters (25.98 inches) wide, 68 by 44 picks, weighs 3 yards per pound, and is being bought at 50 centimes (9.65 cents) per yard c. i. f. Constantinople, less the usual 5 per cent discount.

Remnants of all kinds have a wide sale in Turkey, and the dealers in Constantinople state that they have difficulty in supplying the demand. Both white and colored remnants are wanted; they come in 2 to 20 yard lengths with about 100 yards to each bundle, and fairly good prices are obtained for them. Remnants of heavy gray sheetings, for example, are being bought by importers at prices ranging from 30 to 35 centimes (5.79 to 6.75 cents) per yard c. i. f. Constantinople. Almost any variety of goods can be sold under this head. Two importers stated that they would take almost any quantity of remnants, provided the goods were well assorted. Their names are transmitted with this report [and may be obtained from the Bureau of Manufactures].

COLORED GOODS.

Prints form the largest single item of cotton goods imported by Turkey, and, including printed flannels, they amount to nearly \$15,000,000 annually. Of the trade in prints proper, England has about 60 per cent. Italy has had 15 per cent, and the remainder is divided up among Germany, Austria-Hungary, Netherlands, France, and Russia. England and Italy, and recently Spain, provide the cheaper grades, which are most widely sold, while the better qualities come from the other countries named.

The success of the English is due not only to the fact that they produce cheap prints, but that they offer a very wide range of patterns and are willing to give any assortment the customer demands. The goods are usually bought in the gray and printed by the Syndicate of Printers in Manchester at a cost of 1d. to 1½d. (2 to 3 cents)

per yard. Italian prints are liked because of the bright rich colors and attractive designs that are offered. While these goods come in a variety of widths, the 27/28 and 28/29 inch are the most popular. There is no standard length of pieces, but they usually contain 35 to 50 yards and are put up both narrow, quarter-yard fold, and wound on boards. A quality of print enjoying a wide sale is 27 inches wide, 64 by 64 construction, and is bought at 27 to 30 centimes (5.21 to 5.79 cents) per yard c. i. f. Constantinople. There are also cheaper grades selling at 4 to 5 cents per yard and better qualities quoted as high as 50 to 75 centimes (9.65 to 14.47 cents).

DESIGNS DESIRED.

However, quality appears to be secondary to the question of patterns. While it is essential that a cheap print be offered, it is equally, if not more, important that designs be furnished which are in vogue here, and that the colors be bright and fairly fast. More than three or four color patterns are not demanded, some of the most popular being indigo ground with brown or yellow fruit or flower designs; black with red or white; white with blue and red; red with black. The taste of the people runs to rather gaudy designs with large figures. Many of the firms here have special designers in Constantinople who prepare the patterns desired, while others make selections from the large number of designs submitted by the manufacturer. Numerous swatches of prints showing the patterns that can be sold here are furnished with this report.

Very few American prints are on the market. One firm claimed that goods ordered as 64 by 56 picks proved on arrival to be only 56 by 48. It has also been difficult to secure from the United States the designs desired because they differ widely from those sold on the domestic market, and manufacturers seemingly have not found it worth while to get up the special patterns. Sometimes they can furnish some of the designs, but in such cases the importers complain that they agree to furnish only standard assorted cases or bales, which usually contain many patterns absolutely unsalable in Turkey. It is highly probable that American prints could be sold in this market if manufacturers furnished the designs demanded, because the prices are not prohibitive. The best plan would be to make up a wide assortment of samples, based on the designs forwarded with this report, and submit them to the importers. It is believed that the trade that might be built up by the manufacturer who makes a serious effort to enter the market would justify the initial expense involved.

PRINTED FLANNELS—BARCHENT.

Printed flannels rank next in importance to prints, and there is a heavy demand for these goods, which are used in winter for women's dresses and men's shirts. The bulk of the trade was formerly held by the Italians, but since the war orders have been placed with Germany, France, Austria-Hungary, Belgium, and Spain. England does not figure very largely, except in the very cheap grades. As a rule, the prices quoted by the Italians and Spanish are considerably lower than those of other countries. For example, a merchant stated that he was now buying flannels from Germany at 60 to 65 centimes per

meter (10.58 to 11.46 cents per yard), which were almost identical with goods which he formerly purchased from Italy for 45 to 50 centimes per meter (7.93 to 8.82 cents per yard). This refers, however, to the better grades. The qualities enjoying the widest sale are now quoted at 35 to 40 centimes per meter (6.17 to 7.05 cents per yard) c. i. f. Constantinople, all prices, of course, being subject to 5 per cent discount. The 68/70 and 78/80 centimeter widths are most popular. The goods usually come in pieces of 35 to 40 meters, are wound on boards, and are afterwards wrapped in paper or a kind of waxed cloth.

In general, the designs are showy and striking. A red or brown ground with yellow or green designs of cherries, flowers, etc., is very popular. Another class of patterns much in demand has a black ground with white or dark red designs, made up in imitation of wool. A short nap is characteristic of all the flannels sold here. Numerous pattern sheets showing what the trade demands are furnished with this report.

Barchant, which is printed on one side and napped on the other, is an important item in the Turkish trade. In general, it follows the line of flannels as regards widths and patterns, but it is a coarser fabric and is sold at a lower price. The cheapest varieties are woven in double widths and split, making a cloth 55 to 60 centimeters (21.65 to 23.62 inches) wide. Italy long enjoyed a large share of this trade, but first place is now held by Germany; Austria and England furnish smaller quantities.

VICHY AND DOCUMA.

Another line of colored goods which is widely sold and in which it is believed American manufacturers can compete is the so-called vichy cloth, which is a cheap gingham or plaid. The Austrians were among the first to introduce this cloth, but the Italian and Spanish manufacturers were quick to imitate it, and by furnishing good designs at lower prices soon obtained a large part of the trade. At present practically all the competing nations supply these goods because the demand has greatly increased. The cheaper qualities come from Spain, England, Switzerland, and the Netherlands, while France, Germany, and Austria furnish the better grades.

Vichy comes in widths of 70 to 95 centimeters (27.56 to 37.4 inches), in lengths of 45 to 50 yards or meters, and in long, narrow, and book fold. The best seller is 93/94 centimeters (36.6/37 inches) wide, 72 by 68 and 76 by 68 construction. The former is quoted at 55 centimes per meter (9.7 cents per yard) and the latter at 56 centimes per meter (9.88 cents per yard) c. i. f. Constantinople, less 5 per cent. There are cheaper qualities on the market selling at 6 to 8 cents and better grades for 11 to 14 cents per yard, but the strongest demand seems to be for the medium-priced goods. A sample of Austrian vichy that is very popular is furnished with this report. It is furnished in 68 by 68 construction and in widths of 70, 75, 80, and 95 centimeters, the last-named width selling at 44 centimes per meter (7.76 cents per yard). A little better quality with 72 by 72 picks per inch sells for 53 to 54 centimes per meter (9.35 to 9.53 cents per yard).

A stiff starchy finish is desired. The designs are many and varied and new ones are constantly being placed on the market. Elaborate and fancy patterns are not very much in demand, the most popular

being ordinary checks and stripes in black and white, blue and white, and red and white, and sometimes with three and four box patterns. Pin stripes and checks are also sold to some extent. An idea of the designs in vogue may be obtained from the samples furnished.

A fabric somewhat similar to vichy, but usually wider, coarser, and with a softer finish, is the so-called "documa," for which there appears to be a steadily increasing demand and which is used for bed and table covers, cheap curtains, and sometimes for women's skirts. England and Austria share in this trade but the better qualities are bought from Germany. The goods are packed long fold with 40 meters to the piece. The widths generally sold are 90, 100, 110, 120, and 130 centimeters, the price being based on the 100-centimeter (39.37-inch) width, with a difference of 5 to 6 centimes per meter (0.882 to 1.06 cents per yard) for each variation of 10 centimeters (3.9 inches). A sample forwarded is 130 centimeters (51.18 inches) wide, 52 by 52 picks, weighs 2.75 yards per pound, and sells for 57 centimes per meter (10.05 cents per yard) c. i. f. Constantinople. This fabric is plain woven, with 20s warp and 14s filling, dyed with aniline colors, with large check designs. American manufacturers would have no difficulty in making it at a competitive price.

OTHER COLORED GOODS.

Prints, flannels, and cheap gingham represent the lines constituting the bulk of the trade in colored cotton cloth. Various other goods are sold on this market, but the trade in any one of them is not considerable. Zephyrs, oxfords, and fine gingham come from England and Germany, and satins and linings from England; velvets come from Germany, Austria, and England, but the finest are from France. The consumption of corduroys is increasing. Printed handkerchiefs and head shawls are supplied largely by Switzerland; bed and table covers come from England, Germany, and Austria, as do laces, tapes, and braids. Italy formerly had a good trade in trouserings, cottonades, and similar goods, but they are now being furnished by Germany and Austria, with smaller quantities from Belgium and Switzerland. Austria leads in the trade in ready-made clothing and knit goods, being followed by Germany and France. As a rule the finer qualities come from the latter country.

Cotton ticking is imported to some extent. It is usually furnished in 22, 24, and 32 inch widths and the patterns generally follow the standard ticking designs, with stripes in blue and white, or red and white; blue and white are most popular. A sample furnished with this report is 22 inches wide, 68 by 40 picks, two up and one down weave, and weighs 4 yards per pound. The goods are quoted at 7.75 francs per piece of 31 meters, which is equivalent to 4.41 cents per yard. This is apparently a very low price, but the goods are rather heavily starched and probably weigh 5 yards to the pound unfinished.

DENIMS AND KHAKI CLOTH.

In the line of trouserings, or "materia," as they are called here, denims have become very popular in Turkey. They are sold in widths of 60 to 100 centimeters (23.62 to 39.37 inches) and in pieces of 50 to 52 meters; the narrow widths (60 to 62 centimeters) have the

best sale. Italy formerly supplied the bulk of these goods, but they are being bought from Austria, Germany, and Belgium at present. The quality sold is considerably inferior to those of American manufacture. They are both 2/1 and 3/1 twill construction and 16s to 18s warp is used with 4s to 6s filling, the latter being spun largely from waste cotton which is dyed blue, brown, or black. The warp is white and the filling colored in contrast to the American denims, in which the reverse is usually true. Two samples furnished with this report will show the weights and constructions preferred. One of these sells at 33 centimes per meter (5.82 cents per yard) and the other at 41 centimes per meter (7.23 cents per yard) c. i. f. Constantinople.

One American firm has begun to introduce denims with some success. It is a splendid opportunity to open up trade, because this class of goods is constantly becoming more popular with the natives in the interior, and the general opinion among the dealers in Constantinople seems to be that a good business can be done in a better quality of denims selling at 9 to 12 cents per meter.

There is not a very considerable demand for khaki in the open market, but the War Department uses several million yards annually. A sample of the quality desired is furnished. It is specified by the Government that the goods shall be 70 centimeters (27.56 inches) wide, 40 to 50 yards per piece, 38 by 24 threads per square centimeter (0.155 square inch), and weigh 235 to 250 grams per square meter (6.92 to 7.37 ounces per square yard). This cloth, like all supplies for the Government, is bought by adjudication, but the price paid on a recent order was 15 cents per meter (13.72 cents per yard) c. i. f. Constantinople. The Italians had a large part of this business up to the outbreak of the war; it is now being furnished by England and Austria.

In doing business with the Government it is essential to have a thoroughly reliable agent on the ground, and in the beginning it would be advisable to make some concessions. The Government is very much inclined to look with favor on American cotton goods, because of their high reputation for quality. Only recently a large order for heavy sheeting was received by an American manufacturer. Much more can be done in this line if the proper efforts are made, not only in such goods as sheeting, duck, and khaki, but in woolen goods, knapsacks, shoes, army tents, and various other supplies. A representative of one of the leading makers of wagons in America has been here recently to secure a contract for more than a thousand ambulances and provision wagons. In the severe tests that were conducted the wagons proved to be far superior to all others submitted, and at the time this report is written (April, 1912) it seems more than likely that the United States will secure the order.

FACTORS IN DEVELOPMENT OF MARKET.

CUSTOMS REGULATIONS—TARIFF.

The Turkish tariff on practically all articles is 11 per cent on the invoiced value of the goods. For the purpose of levying duties the importer is required to prepare a declaration, giving details of the merchandise, its weight, number and contents of packages, and cost. In case the customs authorities have any doubt as to the correctness of the declaration, they can demand the original invoice of the manufacturer or exporter, on which the following certification, in French, must appear duly signed: "Nous certifions que cette facture est authentique et qu'elle est la seule émise par notre maison pour les marchandises y mentionnées." Other evidence in support of the importer's declaration may be demanded in case there is suspicion of fraud.

There are some unscrupulous dealers here who sometimes suggest that, as the customs regulations are intricate and confusing and as Turkish weights and measures must be given (which is not the case), the seller should forward a blank invoice properly certified to be filled out, according to the requirements, by the importer himself. The object, of course, is to declare a false value and use the invoice to support it. This practice is not so general as in former years, owing to the reforms in the administration of the customs. American and British firms bear a high reputation for reliability in the matter of invoices.

MONEY, WEIGHTS, AND MEASURES.

Turkish money is essentially silver on a nominally gold basis. The gold lira, or pound, which has a value of \$4.40 in United States currency, is assumed to consist of 100 piasters gold, but in reality the gold piaster does not exist, and owing to the depreciated value of the silver currency the value of a pound in silver piasters varies from 108 to 120 in different parts of the country. As a matter of fact, the gold coins of all European countries circulate freely at current rates of exchange, but they are not legal tender.

Although the metric system of weights and measures was declared obligatory a number of years ago, it has never come into general use. The Turkish oke is about 2.8 pounds avoirdupois and a cantar is 44 okes, or about 125 pounds. In cloth measure theoretically the endazé, or pic, of 64 centimeters (25.197 inches) is used in measuring silk goods and coarse woolen cloth, while the arshin of 68 centimeters (26.77 inches) is used for measuring all other kinds of cloth. In practice the two measures are often used interchangeably, and the system is further confused by the fact that the arshin in carpenter's measure is 29.83 inches. Among the importers of cotton goods both the yard and meter are used, but it is preferable that quotations be made by the metric system and in francs. As regards languages, it is advisable that correspondence be in French.

TRANSPORTATION.

Several factors have secured to European manufacturers a practical monopoly of the cotton-goods trade of Turkey, among which are a careful study of the demands of the trade and local conditions, the selection of competent and reliable agents, willingness to accept small orders and to make the designs and to pack bales or cases as wanted, quoting c. i. f. a Turkish port, good shipping facilities that insure the prompt and safe arrival of goods, and the granting of liberal terms of credit.

One of the most serious drawbacks to the development of American trade is the lack of direct steamship service. Goods transshipped at Liverpool, Hamburg, Naples, or Piræus are subject to both delay and damage, often entailing financial loss on the importer, with the result that after a few experiences of this kind orders are sent to European houses. The freight rate on cotton goods from New York to Constantinople varies between 25s. and 30s. (\$6.08 and \$7.30) per measurement ton of 40 cubic feet, and amounts to only about 2 or 3 per cent of the value of the goods. But there are additional expenses for insurance, transshipment, forwarding, and incidentals, the exact amount of which is uncertain, and this hinders the development of trade. Far more satisfactory results would be obtained if prices were quoted c. i. f. a Turkish port, as is the rule with the European manufacturers. It is even possible to quote franco domicile, as the Italians sometimes do, because the Turkish tariff on all imports is uniformly 11 per cent of the invoice value. It is far more satisfactory to the dealer here to know just what the goods will cost him landed at his door. Proximity to the market, good shipping facilities, and c. i. f. or franco domicile quotations have contributed very largely to the wonderful growth of the Italian cotton-goods trade, aside from the fact that the manufacturers of that country have thoroughly studied the market, have established competent and reliable agents, and have concentrated their efforts to produce the cheap goods demanded in Turkey.

Direct steamship service to Turkey would undoubtedly be of great assistance in promoting the trade of the United States, because it would eliminate the troubles, delays, and loss incidental to transshipments. Under present conditions the best that can be done is to quote prices c. i. f. Constantinople, or at least give the importer here an approximate idea of the freight and other charges to which the goods will be subject. The Germans send to the importers a printed tariff giving the rates from all the more important German cities to various points in Turkey. The dealer here is thus able to figure the cost of the goods delivered, and competition is so keen that this knowledge is essential to the establishment of trade in any line. In exhibiting samples of American cotton cloth to the leading dealers it was sometimes found that prices were lower than those of similar European fabrics; but the latter were c. i. f. Constantinople while the former were f. o. b. New York. The natural question of the importer is "What will it cost me to get the goods here?"

TERMS OF CREDIT.

These obstacles to the growth of American trade—inadequate transportation facilities, delays in delivery, and uncertainty as to freight

and other charges—are no more important than the question of credit. In my many interviews with large dealers and importers of cotton goods, the first question asked was: "What are your terms?" The persistent demand of American manufacturers for cash before shipment or cash with order is probably the greatest hindrance to the development of American trade in Turkey to-day, because business here is on a credit basis, and however strong financially a firm may be, rather than pay cash in advance it will give the order to a European house that extends liberal terms.

Cotton goods are sold by Italy, Germany, Austria, and Spain at 5 per cent discount for cash in 30 days after arrival of the shipment; England usually gives 2½ to 3 per cent. But, as in the case of yarn, the 5 per cent is always deducted whether payment is made in three, four, five, or six months. Often the goods are sold on three months' open credit, at the end of which time an acceptance is given payable in three months. As a rule, Italy and Germany grant the most liberal terms, while England is more strict. The trade of England is, however, distinct from that of other countries, owing to the fact that nearly all the large cotton-goods merchants in Constantinople maintain branch houses in Manchester, which attend to all details of buying and credit.

VIEW OF IMPORTERS ON CREDIT.

The opinion of nearly all the influential business men and importers in Constantinople, as expressed in interviews, was that American trade is suffering because the manufacturers of the United States appear to have no faith in the commercial integrity of the buyers in Turkey. To quote one of these men:

Nobody doubts the superiority of American goods in many lines, but it is necessary that facilities similar to those granted by European concerns be offered by Americans in order to get the hold they should have in this market. People who have money to spend or invest are not forced to accept American goods which are little known to them when there are hundreds of European manufacturers always ready to accept any reasonable proposition and offer liberal terms in order to introduce their products. Turkish business men will never agree to put up cash in New York until absolutely convinced that what they are to receive by so doing is better than what they can purchase in Europe on three months' time.

However, it is not to be denied that the exactions of American manufacturers are not without reason, because in times past not a few of them have suffered serious losses through the extension of too liberal terms of credit. American exporters should not lose sight of the fact, however, that changed conditions in Turkey have placed business on a more sound and stable basis, that public and private credit have been considerably raised in recent years, and that there are business firms and dealers in Turkey who have abundant capital and whose commercial integrity is unquestioned. The exercise of ordinary care and the employment of the means available for ascertaining the financial standing of importers would make it possible to grant the necessary accommodation without danger of loss. In practically every case where American manufacturers have suffered by extending credit in Turkey, proper efforts were not made to ascertain the standing of the dealer, and even the precautions used in domestic business were lacking. An American credit agency has a representative in Constantinople through which inquiries in regard to importers may be made.

AMERICAN CHAMBER OF COMMERCE.

Another splendid source of information of this kind is the American Chamber of Commerce for the Levant, which was established in March, 1911, and has its headquarters in Constantinople, with branches in Saloniki and Smyrna and members in all parts of Turkey, the Balkans, Greece, and Egypt. Starting with 75, the membership has grown to nearly 500. The chamber is composed of men who are seriously and earnestly interested in the development of Turkish-American trade, and the object of the organization, as stated in its constitution, is: "To examine questions concerning the commercial, industrial, and financial relations between the United States of America and Turkey; to protect interests of that character subsisting between individuals and firms in the two aforesaid countries; and to take all possible measures which may encourage the transaction of business between them; the chamber shall collect information touching the above interests for the benefit of its members, so as to facilitate their business operations." A number of American manufacturers have joined the chamber and the benefits that will accrue to those interested in securing trade in Turkey by affiliating with this organization are many and varied. Due care is exercised to maintain the high standard of the body, and firms that are not known to be absolutely reliable are excluded from membership.

Undoubtedly this organized effort to promote our commercial relations with Turkey will have far-reaching results and it should be heartily supported by American manufacturers. For some time now the chamber has been working to secure a direct line of steamers. The activities of the chamber in other lines are no less important. Full and reliable information in regard to the market and its requirements is furnished to manufacturers and dealers, both in Turkey and in the United States, good agents to represent American exporters are secured or recommended, and inquiries respecting the financial standing of firms are given careful attention.

The organ of the chamber, the Levant Trade Review, is published quarterly, and it is a splendid and creditable journal. By presenting up-to-date and interesting articles in regard to the Levant and the United States it furthers a wider knowledge of the trade conditions of each, while its advertising pages offer a splendid opportunity for American manufacturers to bring their products to the attention of people who seriously desire to increase the sale of American articles in this market.

CARE IN SELECTING AGENTS.

American exporters have sometimes suffered considerably from the lack of ordinary care in the selection of agents. It is of supreme importance that competent representatives be secured. Too often the agent is no more than a broker, who sells on commission and assumes no obligations. This agent generally sells to the large dealers, who are themselves importers, and another middleman is added to cut down the profit of the American manufacturer or exporter. In cotton goods particularly it is advisable to select as representatives one of the large wholesale houses here with whom business can be transacted direct, or else secure as agent a man who is financially responsible and who will buy the goods outright.

It is also important, after selecting an agent, to protect him and to refer all inquiries to him. The policy of selling goods to any firm that orders them, often at different prices and without due regard for the agent, is one that has been detrimental to American trade, because it frequently results in competition in the same line of goods with consequent loss to the agent and to the manufacturer. Too much territory, however, should not be given to one agent, because Turkey is a country of many races and the habits, tastes, and requirements of the people are not the same in every section. A good working arrangement would be to have representatives in Constantinople, Saloniki, Smyrna, and possibly Trebizond, and in Aleppo and Beirut, in Syria.

If the same care is exercised in establishing selling arrangements in Turkey as in the home market, if the suggestions of the agents with regard to the demands of the trade and the classes and patterns of goods desired are seriously considered and carefully followed, if orders are given prompt attention, goods properly and securely packed to prevent damage, and carefully routed to avoid delay, and if some concessions are made in respect to payments, American cotton goods will undoubtedly secure a foothold in this market. It is a most opportune time seriously to institute an American commercial invasion of Turkey. The Chamber of Commerce is a live and active organization, ready and anxious to assist in the development of trade, while the efficient American Consular Service in Turkey may be counted upon to cooperate heartily in promoting closer commercial relations between the two countries.

OPPORTUNE TIME TO ENTER MARKET.

The cheap Italian cotton goods that in the past few years have practically driven American cloth off the market and have seriously menaced the trade of European countries have been eliminated on account of the war, and the people are looking to other countries to supply the deficiency. An opportunity is offered to American manufacturers such as has never been presented before to secure a share of a cotton-goods trade that exceeds \$50,000,000 annually and which is steadily, almost rapidly, increasing. In order to participate in this trade it is necessary to follow the suggestions that have been outlined. By studying the local requirements, the habits, tastes, and prejudices of the people and the business methods which obtain in the country; by securing competent and exclusive representatives to push the sale of goods and by making fabrics that conform in every particular to the demands of the trade; by supporting the agent through prompt and careful attention to orders and shipping instructions—by these methods American cotton goods, particularly sheetings, drills, duck, and similar cloths, may profitably be placed on this market.

If American manufacturers were as persistent in their efforts to sell products abroad as they are in demands for "cash before shipment," there would be a considerable expansion in our foreign trade. The recent sale of nearly 1,000,000 yards of gray sheeting to the Turkish Government is an evidence of the possibilities that await us here, and weakens the theory that has unfortunately gained credence in Turkey that American cotton goods are very much higher in price than those of European manufacture.

The future undoubtedly points to an increase in the volume of our trade with Turkey. American colleges and schools in various parts of the country are disseminating knowledge of the United States and exercising a powerful influence in securing a more favorable consideration of articles of American manufacture. Graduates of these schools are becoming the leaders of thought and action in their respective native communities, in Asia Minor, Mesopotamia, Arabia, Syria, and in the Balkans; they have been one of the prime factors in the intellectual awakening in Turkey and will undoubtedly play a leading part in the industrial, social, and economic progress of the country.

Through the organized efforts of the Chamber of Commerce and the Consular Service, American manufacturers are being assisted and supported in their attempts to enter the market, while American purchases of Turkish products are annually increasing at a rapid rate, a factor that will contribute to the early establishment of better transportation facilities and will bring the two countries into closer commercial relations. It rests largely with American manufacturers to take advantage of these conditions and seriously to set about the exploitation of this important market for the sale of manufactured goods.

LIST OF SAMPLES.

The samples mentioned in the foregoing report will be loaned, upon application, to interested firms by the Bureau of Manufactures. In the following list is given a brief description of these samples, with a statement as to country of origin and price.

Sample 1.—Cabot; imported from Austria-Hungary; 38 inches wide; 60 by 60 picks; 2.5 yards per pound; wholesale price to importers, 45 centimes per meter (7.93 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 2.—Cabot; imported from Italy; 100 centimeters (39.37 inches) wide; 52 by 48 picks; 2.75 yards per pound; price to importers, 36 centimes per meter (6.35 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 3.—Cabot; imported from England; 28 inches wide; 64 by 64 picks; 3 yards per pound; price to importers, 3d. (6 cents) per yard f. o. b. Liverpool.

Sample 4.—Cabot; imported from Egypt; 34 inches wide; 52 by 52 picks; 2.5 yards per pound; price to importers, 38.5 centimes (7.43 cents) per yard c. i. f. Constantinople.

Sample 5.—Sheeting; imported from England; 38 inches wide; 64 by 48 picks; 2.75 yards per pound; price to importers, 7 cents per yard c. i. f. Constantinople.

Sample 6.—T cloth; imported from England; 30 inches wide; 72 by 72 picks; 3.25 yards per pound; 24 laps (23 yards) per piece; price to importers, 6½ cents per yard c. i. f. Constantinople. For each 2 inches increase in width price is 8 cents more on the piece of 23 yards.

Sample 7.—T cloth; imported from England; sample is most popular style on the market; 38 inches wide; 72 by 72 picks; 2.5 yards per pound; 23 yards per piece; price to importers, 7s. 2d. (\$1.74) per piece f. o. b. Liverpool; made in 32, 34, and 36 inch widths also, the price being 8 cents less on the piece for each difference of 2 inches in width.

Sample 8.—T cloth; imported from England; 28 inches wide; 72 by 72 picks; 3.25 yards per pound; 24 laps (22 yards) per piece; price to importers, 6½ cents per yard f. o. b. Liverpool.

Sample 9.—T cloth, or cabot; used very largely by the Turkish Army but also sold in the open market; 32 inches wide; 72 by 76 picks; 2.85 yards per pound; 24 laps (22 yards) per piece; price per piece, 6s. 1½d. (\$1.49) f. o. b. Liverpool.

Sample 10.—Gray shirting; imported from England; 38½ inches wide; 64 by 64 picks; 3.25 yards per pound; 37 yards per piece; price per piece, 8s. 10d. (\$2.15) f. o. b. Liverpool.

Sample 11.—Gray shirting; imported from England; 30 inches wide; 60 by 44 picks; 4 yards per pound; 35 yards per piece; price, 4½ cents per yard f. o. b. Liverpool.

Sample 12.—Popular design of flannel sold in Turkey; this quality is 66/67 centimeters (26/26.4 inches) wide; price, 40 to 41 centimes per meter (7.05 to 7.23 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 13.—Printed flannel; imported from Germany; 27 inches wide; 40 to 50 yards per piece; long fold; price, 46 centimes per meter (8.11 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 14.—Barchent; imported from Italy; 27 inches wide; 40 to 50 yards per piece; long fold; price, 47 centimes per meter (8.28 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 15.—Ticking sold in Turkey; comes in widths of 22, 24, and 32 inches; 31 to 32 meters per piece; sample was imported from the Netherlands; it is 22 inches wide, 68 by 40 picks, three-leaf twill weave; price, 7.75 francs per piece (4.41 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 16.—Denim sold in Turkey; supplied in various widths from 22 to 36 inches; comes mostly from the Netherlands and Germany; price of 24-inch width, 33 centimes per meter (5.82 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 17.—Denim; price of 24-inch width, 41 centimes per meter (7.23 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 18.—Denim; from the Netherlands; 25 inches wide; price, 47 centimes per meter (8.28 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 19.—Prints sold in Turkey; come in widths of 25 to 34 inches; 50 to 55 yards per piece; long fold; 28/29-inch width (finished) is most popular, and in this

quality the present price is 3d. (6 cents) per yard, less 5 per cent discount, f. o. b. Liverpool.

Sample 20.—Vichy cloth; imported from Germany; 80 centimeters (31.5 inches) wide; price, 44 centimes per meter (7.76 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 21.—Vichy; imported from France; 93 to 95 centimeters (36.6 to 37.4 inches) wide; price, 55 to 56 centimes per meter (9.7 to 9.98 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 22.—Vichy; imported from Germany; 93 to 95 centimeters (36.6 to 37.4 inches) wide; price, 53 to 54 centimes per meter (9.35 to 9.53 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 23.—Popular patterns of vichy sold in Turkey; come in 70 to 95 centimeter (27.6 to 37.4 inch) widths, but the 93/95 centimeter (36.6/37.4 inch) is most in demand; pieces usually 50 to 55 yards; both long and book fold; this quality in 95-centimeter width is sold at 50 centimes per meter (8.82 cents per yard), less 5 per cent discount, c. i. f. Constantinople.

Sample 24.—Documa (cheap gingham); imported from Germany; 130 centimeters (51.2 inches) wide; 52 by 52 picks; 2.75 yards per pound; price, 57 centimes (11 cents) per yard, less 5 per cent discount, c. i. f. Constantinople.

Sample 25.—Khaki cloth; used by the Turkish army to the extent of more than 1,000,000 meters annually; goods must be 70 centimeters (27.6 inches) wide, 40 to 50 yards per piece, 38 by 24 threads per square centimeter (0.155 square inch), and must weigh 235 to 250 grams per meter (6.92 to 7.37 ounces per square yard). Goods are purchased by the War Department by adjudication, but the price ranges from 14 to 16 cents per meter (12.8 to 14.6 cents per yard).

Sample 26.—Madapollam; imported from England; usually bought by the dealers in the gray and afterwards finished by the firm of Pilsworth. Sample shows the so-called "Pilsworth" finish, much in demand here. This quality is 34½ inches wide, 36 yards to the piece, 68 by 64 picks per inch, 3.5 yards per pound, and sells for 6.5 to 6.75 cents per yard, c. i. f. Constantinople, with discount of 3 per cent in some cases and 5 per cent in others. Thirty days' time after receipt of goods is all the credit usually allowed. A better quality of madapollam, and what is considered the standard goods, is 72 by 80 picks, 36 inches wide, and sells at 10½s. to 11s. (\$2.55 to \$2.67) per piece of 36 yards, or 7.09 to 7.43 cents per yard, c. i. f. Constantinople, with 3 to 5 per cent discount.

Sample 27.—Blue drill; imported from the Netherlands; this quality has a fair sale in Turkey; 66 centimeters (25.9 inches) wide; 68 by 44 picks; 3 yards per pound; price, 50 centimes per meter (9.6 cents per yard), c. i. f. Constantinople.

Sample 28.—Numerous patterns showing the designs of flannels and prints in demand on the Turkish market.



DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 55

ELECTRICAL INSTRUMENTS IN ENGLAND

By

H. B. BROOKS

Commercial Agent of the Department of Commerce and Labor

**TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD**



**WASHINGTON
GOVERNMENT PRINTING OFFICE
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LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE AND LABOR,

Washington, June 11, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1912, approved March 4, 1911, a report by Commercial Agent H. B. Brooks, of this department, containing the result of his investigations of the trade in electrical instruments in England.

Respectfully,

BENJ. S. CABLE,

Acting Secretary.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,

Washington, May 10, 1912.

SIR: I have the honor to submit herewith a series of reports by Commercial Agent H. B. Brooks dealing with the manufacture of electrical instruments in England. The works of seven leading firms are described, attention being paid to equipment, number of employees and hours of labor, and especially to the nature of the products manufactured. A number of consular reports relating to the use of electrical switches in England are also included in the monograph.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

TO HON. CHARLES NAGEL,
Secretary of Commerce and Labor.

H D—62-2—vol 98—41

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ELECTRICAL INSTRUMENTS IN ENGLAND.

ELECTRICAL APPARATUS CO. (LTD.).

The works of the Electrical Apparatus Co. (Ltd.) are located near Vauxhall Station, in the southern part of London. The present building will accommodate 250 workmen, and the site will permit extension of the building to accommodate 200 more. The company has practically no American equipment, as it finds the products of the English machine-tool makers satisfactory. The equipment is very complete, the company making even such standard parts as nuts and screws. No American material is used, with the possible exception of copper. Female labor is employed only in the offices.

A prominent feature of the company's work is the manufacture of motor starters of original design, including a slow-motion, or "fool-proof," starter, in which a ratchet motion obliges the operator to advance the starting lever from the middle of one contact step to the middle of the next one, it being impossible to advance more than one step at a time. If for any reason it is desirable to throw the lever back to the open-circuit position, or if the voltage fails while the motor is running, there is no impediment to the free backward movement of the lever.

THE COMPANY'S AMPERE-HOUR METER.

The product of chief interest is the company's ampere-hour meter, which is designated as the E. A. C. high-torque meter. The general form is very similar to that of small induction watt-hour meters brought out by several of the leading American makers a year or two ago.

The armature coils, three in number, are wound in "pancake" form and are inclosed within two thin aluminum disks, with suitable insulation. (The complete armature is tested with 500 volts for insulation between shaft and frame.) The disks are then spun together. The commutator has three segments of 18-carat gold insulated from the steel shaft by a tube of ebonite. The brushes are tipped with gold contacts, which make an edgewise contact on the commutator; thus a small total pressure of the brush on the commutator gives a relatively large pressure per unit of contact surface and tends to insure good contact. The lower shaft end, which is removable, is protected by a brass cap.

The armature revolves in the field of two strong permanent magnets, which thus supply the working field for the armature coils and the retarding field for the drag disk. The winding is such as to require about 1 volt drop at full load, the armature current being about 0.25 ampere. The armature resistance is thus relatively high for an ampere-hour meter, and variations of brush contact resistance are said to have a negligible effect upon the accuracy.

NONINDUCTIVE SHUNT.

The armature circuit is connected in parallel with an alloy shunt of negligible temperature coefficient. At first thought it would appear that the inductance of a direct-current shunt was of no consequence. However, it has been found that when a meter with an inductive shunt is subjected to a short circuit, the inductance of the shunt tends to increase the relative proportion of current through the armature. The meters as now constructed have the shunt wire reflexed to give a more nearly noninductive shunt.

Other constructional details of the meter are given as follows: Magnets are of tungsten steel; jewels of Ceylon sapphire; mica only is used as insulating material. A substantial cast-iron case is used, with provision for excluding dust and dampness.

Meters of the same capacity are tested in series, using indicating ammeter and stop watch. Several of the ammeters are of American make. The company's output of meters is about 10,000 per year. These are sold chiefly to English central stations.

EDISON & SWAN ELECTRIC LIGHT CO. (LTD.).

The Edison & Swan Electric Light Co. (Ltd.) was formed in 1884 for the manufacture of incandescent lamps and fittings. The company's works are located at Ponders End, Middlesex, north of London, and are very extensive. The equipment includes machine tools of English, German, and American make. The company's product is primarily electric-lighting apparatus and supplies, including arc and incandescent lamps, switchboards, and wiring devices. In addition, various patented specialties are made for foreign owners, who are required by British law to manufacture articles in England in order to maintain their English patent rights.

As a part of its regular product the company makes electrical measuring instruments. The direct-current instruments are of the moving-coil type. The company uses manganin for ammeter shunts on account of its low thermal electromotive force. Most makers construct ammeter shunts by soldering the resistance metal into slots cut into the brass or copper terminals. The Edison & Swan Co. casts the terminal around the resistance-metal strips. It is claimed that when this is carefully done a joint results that is practically perfect, and that such shunts will carry much heavier overloads without damage than will the usual soldered shunts. The standard shunt drop at full load is 75 millivolts. (The adoption of this figure is due to the influence of the British standard specification for ammeters and voltmeters.)

CONSTRUCTION OF SOFT-IRON INSTRUMENTS.

Soft-iron instruments are constructed on the repulsion principle, with spring control or gravity control. Air damping is used for many of the soft-iron instruments, the use of die castings making this possible without too great expense. Soft-iron ammeters are also made up as power gauges, the scale being marked in horsepower for some particular motor. To do this the customer sends in the test curve or data for the motor, and the scale of the ammeter is marked accordingly. The cost indicator made by the company is an ammeter

(either switchboard or portable) whose scale is marked in cost per 100 hours at some specified rate of charge for electricity. Instruments of this kind should be very useful in selling electric lamps, heating devices, etc., as the result indicated requires no computation or explanation to the customer, as is necessary when instruments reading in electrical units are used.

CARDEW VOLTMETER—CALIBRATING THE INSTRUMENTS—LABOR.

The Cardew voltmeter is still listed in the company's catalogue, and it is said that they are still used in some central stations. The company also makes portable instruments, both direct current and alternating current, in various forms, including portable instruments with gravity control, which, so far as the writer is aware, are practically unknown in the United States.

In calibrating the instruments manufactured the company uses secondary standard instruments, both alternating current and direct current. The alternating-current secondary standards are periodically checked by comparison with Kelvin balances. These balances are sent once a year to the Board of Trade (Government) laboratory for certification of correctness. The direct-current secondary standards are checked by means of a potentiometer.

The company obtains most of the material used in instrument manufacture from English sources, very little American material being used. The average wages are about 8 shillings (\$1.95) per week for girls and 40 shillings (\$9.73) per week for men. The ordinary working week is 49½ hours. The company's product is marketed principally in the United Kingdom, but a considerable portion is exported to the colonies and other countries. Very little, if any, is marketed in the United States.

EVERSHED & VIGNOLES (LTD.).

The Acton Lane works of Evershed & Vignoles (Ltd.) are located in Chiswick, a residential suburb of London. The present buildings were erected in 1903 and were up to the best practice at that time. The main workshop is a substantial one-story brick building with a saw-tooth roof having the glass to the north.

The arrangement of the machine tools is such that the raw material is received at one end of the shop, where the larger milling machines, presses, lathes, etc., are located. After receiving the heavier operations the material is passed to the middle for operations that can be performed with lighter lathes and drills. The parts pass finally to the farther end of the shop for more delicate work and for final adjustment at the benches. Many of the vertical milling machines are of American manufacture and are well liked by the firm.

MAIN BUILDING—CARD SYSTEM.

The main building is a two-story brick structure adjoining the main workshop. It contains the stores, adjusting rooms, and winding room. The arrangement of the stores is a very convenient one and is the outcome of careful study of this important feature of manufac-

ture. Each rack or bin has a receptacle for a number of cards, upon which entries are made of materials or parts placed in the bin and of quantities removed, with the shop order number. Thus at any time the balance as shown on the card gives the amount of material which should be in the bin. At inventory time the cards are taken to the office for stock taking. A further feature of this card record is the color scheme, one color denoting raw material, another finished parts, etc.

Adjoining the main building is a calibrating room, with battery house. Large storage cells provide currents up to 8,000 amperes for testing heavy shunts; smaller cells provide the steady voltage necessary for voltmeter testing.

THE POWER PLANT—LABOR AND MATERIALS.

The power plant is located in a separate building. Formerly the dynamos were driven by two gas engines supplied with town gas. In December, 1911, a large oil engine was installed in place of one of the gas engines. The oil engine will hereafter do the work and the gas engine will be held in reserve. The offices, drafting, and design departments are in a separate building.

The company has about 300 employees, of whom about 50 are girls employed in the winding room. Under normal conditions 50 hours constitute a week's work. The average employee receives about 1 shilling (24.3 cents) an hour. The men are organized, but the company has not suffered from strikes or other evidences of discontent among the workers. The company draws its supplies of material from English sources, and a member of the firm expressed the opinion that the American producer could not compete with English sources of supply under present conditions.

ELLIOTT BROS.

The firm of Elliott Bros., manufacturers of electrical and mechanical instruments, was founded in 1800, and thus has the distinction of being the longest established in its line in England, if not in the world. In the course of its growth the firm's business was carried on in various locations in London. The buildings at present occupied at Lewisham, in the suburbs of London, were completed and entered in 1900, and are accordingly called the "Century Works."

The main shop and also the main test room are one-story structures, each of which is built integral with a two-story portion. The one-story construction was employed to provide roof lighting for those important parts of the works. The upper floor of the test-room building contains the offices. The cabinet shop and the group of buildings containing the power house, foundry, etc., are one-story buildings.

AMERICAN METHODS—EQUIPMENT.

The firm has adopted American methods and uses many American tools, including Brown & Sharpe milling machines; grinders of American make are also in use. The firm has a high regard for American machine tools of the better class, but since the English makers have greatly improved their products in recent years it is

possible to purchase English equipment, which the firm naturally prefers to do, other things being equal. Herbert's milling machines, for example, are considered by the firm to be very good, and they can usually be bought for less than the high-class American milling machines. In the tool room are lathes made by Brown & Sharpe, Providence, R. I.; Pratt & Whitney, Hartford, Conn.; and Ludwig Loewe & Co., Berlin, Germany; American-made milling machines and shapers are also used.

Group driving is used for most of the machines. A 200-volt direct-current motor drives one or several line shafts. The motors are of uniform size and machines enough to load each motor are connected to it. In the case of a number of small bench lathes the use of individual drive has been found both convenient and economical of power. Each lathe is driven by a one-fourth horsepower direct-current motor mounted on a vertical support from the back of the bench; the round driving belt comes down to the lathe at about 45° to the vertical. The motor has a three-step cone pulley to suit the cone pulley of the lathe; hence no intermediate shafting or gearing is necessary. The motor is started or stopped by a simple switch. The arrangement seems to be a very convenient one for light work, where frequent stoppages occur.

The foundry is equipped with coke and gas furnaces, and produces all the castings used; these are of copper, brass, gun metal, and aluminum. At one time many instrument parts were made by the die-casting process, but this process has been given up, as later methods have been devised by which parts can be produced at equally low cost (in some cases at lower cost) on "capstan" (turret) lathes. Gas-fired ovens are used in the smith's shop for hardening and tempering; the correct temperatures are determined by electrical pyrometer.

ELECTRICAL ENERGY—CABINET SHOP—PRINTING DEPARTMENT.

The electrical energy used in the works is purchased from a local company, the supply being at 2,000 volts alternating current. This is stepped down and is converted by two 100-kilowatt motor generators to 200 volts direct current.

The cabinet shop is equipped with motor-driven machine tools, and produces a large amount of high-grade woodwork for instrument bases and cases, telegraph apparatus, etc. A great deal of woodwork for telegraph and other apparatus intended for use in hot climates is made from teak. This wood, which is but little known in the United States, is immune from attack by ants.

A printing department is maintained that not only provides most of the regular printing and stationery but is also equipped with three special machines for ruling, printing, and punching the long rolls of paper used in the Elliott recording machines. The paper for this purpose is bought in large quantities to close specifications as to quality, thickness, and width, and is given the special treatment that experience has shown to be necessary for the best results.

LABOR AND WAGES.

About 450 employees are engaged in the works, only 21 being female. The latter are employed only in the offices and in some kinds of calibration and testing. The firm's experience is that boys

are better for winding coils. Girls are said to do well at light routine work, but are content to go on year after year doing the same kind of work, whereas the boys are ambitious and desire to learn as many things as possible. A girl may be taught to calibrate 100-ampere ammeters, for example, and will do very well on a lot of these, but if she is to do such instruments one day, another range the next day, and so on, she does not make a success of it and requires too much superintendence. The same characteristic makes her unsuitable for repair work. The working hours for boys and men in the shops are from 7.30 to 12.30 and from 1.30 to 6; work stops at 12.30 on Saturdays. Girls begin work at 9 o'clock, but otherwise the hours are the same as for the men.

The piecework system is used for nearly all parts made in quantity. The average instrument maker earns 8 to 9 pence (16 to 18 cents) per hour. Some of the highest-class men on this work and also the toolmakers earn 10 pence to 1 shilling (20 to 24 cents) an hour, and can do better. The firm never cuts the piecework price unless the method of production is changed so as to reduce the amount of work required. The "time-limit" system is used in the testing room; thus, if 8 hours is the allotted time for a particular piece of work and a man does it in 6 hours, he gets pay for one of the hours saved and the firm saves the other hour. In some English electrical works boys are required to work without pay on entering, or even to pay a premium for the privilege of working. This is not the practice at Elliott Bros.; a boy on entering is paid a minimum of 1½ pence (2½ cents) per hour; his pay is then raised as he acquires skill.

There are about a dozen labor unions, all independent, among the employees, each comprising the men of a particular section of the works. Very little trouble has been experienced from strikes. In January, 1912, there were 3 men employed who had been with the firm continuously for over 40 years, 8 who had been employed over 30 years, 13 over 20 years, and a large number over 10 years.

A number of organizations for the welfare of the employees are in effect. These are known as the amusements committee, the sick club (which pays sick benefits), the loan club, the holiday fund, the library, and the orchestra, which last is under the management of the amusements committee. In addition, written suggestions for improvement of product, methods, etc., are invited from the employees, and a suitable return is made for suggestions which can be used. These features, it is stated, are due to the example of the National Cash Register Co., of Dayton, Ohio.

MATERIALS—THE FIRM'S PRODUCTS.

The firm obtains practically all its materials from British sources, although some specialties, such as Norton grinding wheels, are obtained from America. Aside from the natural desire of the firm to use British material, the American maker or dealer usually asks higher prices, and the long time required to obtain American supplies is a serious drawback. American dealers might compete successfully for large orders with a long time for delivery (say, several months).

The firm's product covers a wide range. Moving-coil direct-current instruments are made in switchboard and in portable forms; alternating-current instruments are made on both the soft-iron and the

electrodynamometer principle; both alternating-current and direct-current recording instruments are made. Current and potential transformers (switchboard and portable) are made for currents up to 3,000 amperes and voltages up to 12,000. Leakage indicators, alternating current and direct current, are made in switchboard form; these instruments are used in England in compliance with the Home Office regulations for the supply of electricity in mines. Portable testing sets are made consisting of two electrodynamometer instruments in a single case. In addition to the more usual combination of voltmeter and ammeter the following combinations are furnished: Two voltmeters, two ammeters, two wattmeters, voltmeter and ammeter, voltmeter and wattmeter, ammeter and wattmeter. Triple sets are also made, having any desired combination of three of the above units. Other portable sets include a fault-localizing bridge, a rail-bond test set, and a photometer.

INTERESTING FEATURES OF THE FIRM'S INSTRUMENTS.

Both the switchboard and portable instruments have window openings of liberal size, giving well-lighted scales, and facilitating the reading of instruments too high from the floor line. Ammeter shunts are electrically interchangeable, as are the millivoltmeters. Furthermore, the shunts are mechanically interchangeable, and this feature is considered to be worth the cost, although requiring a heavy outlay for jigs. Switchboard shunts are made up to 15,000 amperes capacity, and the standard drop at full load is 75 millivolts. (This value is due to the British Standard Specification for Ammeters and Voltmeters, Report No. 49 of the Engineering Standards Committee.)

The resistance material used for the switchboard shunts is eureka alloy, which is extensively used by the British makers; its properties are substantially the same as those of constantan, which is sold in the United States under the trade names of "Advance" and "Ia Ia." Manganin is used for portable shunts to avoid the thermoelectric errors that would be of consequence in the more accurate work for which portable instruments are often employed, such as testing consumers' meters.

All of the firm's precision direct-current ammeters are provided with a temperature-compensating arrangement devised by A. Campbell (see *Journal of the Proceedings of the Institution of Electrical Engineers*, vol. 35, p. 197). This consists of four coils connecting a Wheatstone bridge; two diagonally opposite arms are of manganin and the other two are of copper. The two manganin coils are usually equal, and the copper coils are equal; the relative values of copper and manganin coils are such that the bridge is unbalanced. The millivoltmeter is connected as one diagonal of the bridge, and the other two corners are connected by leads to the potential terminals of the ammeter shunt. This plan is said to give complete temperature compensation with a shunt drop equal to three times the copper drop in the millivoltmeter.

Alternating-current instruments on the electrodynamometer principle are made with moving coils of aluminum wire, surrounding the spherical fixed coil. The use of aluminum wire reduces the moment of inertia of the coil very considerably. These instruments have permanent magnet damping.

SHUNTED WATTMETER.

A novel alternating-current instrument made by the firm is the shunted wattmeter, which was produced in order to avoid the constructional difficulties encountered in "straight-through" wattmeters of the usual type for heavy currents, as well as to provide a wattmeter whose current range can be readily changed. A question that will arise at once is that of possible error due to the lag of the current in the series winding of the wattmeter with respect to the current in the shunt. Following is a brief outline of the manner in which this question is met: The moving coil is the current coil and surrounds the spherical fixed coil, which is wound with relatively fine wire. This fixed coil, with a noninductive added resistance of low temperature coefficient, forms the potential circuit. The angle of lag in this circuit is somewhat greater than the angle of lag of the current in the moving coil with respect to the line current; hence the instrument is made to read correctly by adding inductance to the moving-coil circuit. The adjustment of this inductance is conveniently made by passing the rated current through the shunt from one phase of a two-phase alternator and applying rated voltage from the other phase to the potential circuit. By means of a standard wattmeter of the "straight-through" type whose windings are in the same circuits any small adjustment is made that is needed to bring the current and the voltage into quadrature. The small deflection of the shunted wattmeter is then reduced to zero by adjustment of the added inductance in series with the moving (current) coil. The shunt is made of manganin, while the current-coil circuit is part copper and part manganin. With a drop on the shunt at full load of about one volt, the proportions of copper and manganin are such as to require a temperature correction of about 0.2 per cent per degree centigrade. Shunted electro-dynamometer ammeters are also made.

SOFT-IRON AMMETERS—FORMS OF RECORDING INSTRUMENTS.

Soft-iron ammeters are made on the "straight-through" principle up to five amperes; above that, five-ampere ammeters are used with manganin shunts. This allows the same instrument to be used on either alternating or direct current. When only alternating current is to be measured, current transformers may be used in place of the shunts. Current transformers for switchboard use have the secondary winding highly insulated, and consequently on high-voltage circuits the transformer as a whole must be insulated, usually by mounting it on a porcelain insulator, in case the primary line is not strong enough to support the weight of the transformer. This is the reverse of the usual American practice, which is to provide high insulation on the high-voltage coil; since the secondary circuit is usually grounded, it is not necessary to insulate it highly from the core and case. In constructing potential transformers, the firm follows the usual practice of highly insulating the primary winding.

Recording instruments are made in switchboard and portable forms. For alternating current an electro-dynamometer system is used, with an oil dashpot for damping; for direct current the moving-coil system is used. The clocks are made by the firm; they are interchangeable and can be readily removed from the case, so that a user

of a large number of Elliott recorders can keep a spare clock. An interesting accessory for the recorder is the "telltale attachment," which is simply a small hole covered by a spring flap, at the side of the recorder. A small plunger is provided that will pass through the hole and has a rubber initial on the end. This device is intended for use when it is desired to have a check on the presence of the switchboard attendant, who is required to ink the initial at stated intervals and stamp the paper chart.

RAIL-BOND TEST SET—RESISTANCES.

A rail-bond test set made by the firm consists of two center-zero millivoltmeters mounted in a carrying case. By means of contact rods one millivoltmeter is connected across the rail joint, while the other is connected across a portion of the solid rail. By varying the position of one of the contact rods both millivoltmeters are made to give the same reading; the distance between two of the contact points then gives the length of solid rail, whose resistance is equal to that of the joint.

The firm makes standard resistances, both laboratory and workshop forms, for oil cooling and for air cooling; also plug and dial resistance boxes and bridges. Manganin wire and sheet are used, though, in common with a number of other English makers, the firm considers it a less reliable alloy than platinum-silver or eureka. This latter is generally preferred here for higher values of resistance, where its high thermal electromotive force against copper is not a disadvantage. The Elliott five-dial universal shunt is a piece of resistance apparatus intended to have as many uses as possible. It may be used as an Ayrton-Mather universal galvanometer shunt, as a Wheatstone bridge, a variable rheostat, or a potentiometer. It is stated that a submarine cable station is practically fully equipped for testing with one of these instruments and a galvanometer. An interesting constructional detail is that the contact studs are faced with gold and the levers with platinum. The Elliott potentiometer has a dial of 149 equal coils, in series with a slide wire whose resistance is equal to that of one coil of the dial.

MISCELLANEOUS APPARATUS.

Other apparatus made by Elliott Bros. includes magnetic testing apparatus (the Ewing permeability bridge and the Ewing hysteresis tester) and telegraph apparatus, including the Wheatstone apparatus for rapid telegraphy and the Baudot printing telegraph. Galvanometers are made in many patterns, from the simple detector to the elaborate eight-coil high-insulation Thomson; moving-coil galvanometers are supplied in a variety of forms. Engineering instruments include speed indicators on both mechanical and electrical principles, micrometer calipers, steam-engine indicators, and the Wimperis accelerometer and gradient measurer. A special precision lathe is in use for cutting the screws of the micrometers. The lead screw is a very accurate one, and its small errors are prevented from repeating themselves in the screws cut by the lathe. To these may be added surveying instruments, in the manufacture of which Elliott Bros. have had a very long experience.

The Partridge sparklet fuse made by Elliott Bros. is intended for the protection of high-voltage circuits. It contains two "sparklets" such as are used in aerating liquids. These are placed so that the arc that follows the melting of the fuse melts the thin metal of the sparklets; the resulting rush of gas blows out the arc.

The firm makes a large variety of apparatus for use on shipboard, of which the most interesting from an electrical standpoint is the Anschutz gyro compass. This compass operates on the principle of the gyroscope, the rotating portion being part of an induction motor operating at 20,000 revolutions per minute. To drive this motor high-frequency currents are supplied from a small motor-generator set; on account of the high speed and the large moment of inertia, half an hour is required to bring the compass up from rest to full speed, and it will run several hours after the driving current is broken. This compass makes possible the use of subsidiary compasses about the ship, all of which are under the control of the master compass.

CALIBRATING AND TESTING ELECTRICAL INSTRUMENTS.

In calibrating and testing electrical instruments use is made of "substandard" instruments, which are periodically checked by reference to standards of the best grade. For example, precision direct-current instruments are used as substandards, and are periodically checked against potentiometers. As standard instruments for alternating-current electro-dynamometer instruments are used whose construction is such as to avoid errors due to eddy currents, skin effect, etc. These are checked on direct current. Alternating currents, single and polyphase, are obtained from motor generators. Eight large storage cells, which can be connected in various groupings, provide heavy currents for testing large ammeters and shunts. A battery of 1,000 small storage cells (made in the firm's works) is used for small currents at voltages up to 2,000.

The products of the Century Works are marketed throughout the world, a large part of the production being exported. On account of the high tariff only a relatively small amount goes to the United States, where sales have been confined principally to recording instruments.

FERRANTI (LTD.).

BUILDINGS AND EQUIPMENT—EMPLOYEES.

The electrical engineering works of Messrs. Ferranti (Ltd.) are located in Hollinwood, a suburb of Manchester. The present company was incorporated in 1891, but Ferranti apparatus dates back much farther, S. Z. Ferranti being one of the pioneers in electrical development.

The buildings are of brick and are lighted by windows and from the roof. The machine tools are arranged along the main walls, and are group-driven by 220-volt direct-current motors and line shafting. The firm buys electrical energy, in the form of 3-phase 6,000-volt current, from the local lighting company, and converts it to direct current for distribution about the works.

About half the machines are English and half American. The latter are mainly automatic machines and small turret lathes, of both

of which the company has a large number in use. The conditions under which the machines work are severe, in that they are run night and day. A number of heavy Cleveland automatics are working on mild steel rods about 1 inch in diameter, and have been run night and day for the last three years. The American machine tools are well liked.

The firm's employees number about 1,700, of whom about 80 per cent are engaged in the manufacture of electric meters and instruments. Practically no female labor is employed, the reason assigned being that the neighboring textile mills employ all that is available, at wages greater than can be paid for electrical work. Boys wind coils, run turret lathes, and do assembling, testing, and adjusting. The working week consists of 52½ hours, the single-break system being used. Labor unions are recognized and union wages are paid. There has been practically an entire absence of strikes during the last 10 years.

DIRECT-CURRENT METER, MERCURY TYPE.

The products of the company include transformers, switchboard and control apparatus, electric meters and instruments, and electric heating and cooking apparatus. By far the most important item is that of meters, of which the company is making about 10,000 per month, about half of this number being for direct current.

The Ferranti direct-current meter, Hamilton patent, is of the mercury type. The company recognizes that good accuracy may be obtained from commutator meters when in good condition, but claims that this accuracy is soon lost in service on account of increase of brush friction and deterioration of brush contacts. They state that their 20 years' experience with mercury motor meters has enabled them to overcome the difficulties attending the use of mercury, and in proof of this they cite the fact that their meters have been adopted by large supply companies of England after severe and extended tests. Their mercury meter as made for service use is an ampere-hour meter, the dials being marked to read Board of Trade units (kilowatt hours) at a stated voltage.

In this meter the copper disk is immersed in mercury in a chamber composed of nickel-plated brass top and bottom plates bolted together with a separating ring of fiber or hard rubber; the inner surfaces of the brass plates being further protected by pressspan sheet insulation. Into each brass plate are riveted two mild-steel pole pieces, to which strong permanent magnets are attached. The current enters the mercury by the contact at the right, flows radially across the disk between the right-hand pair of pole pieces, leaves the bath at the central contact, and flows through a compounding coil of a few turns wound on a mild-steel crossbar joining the two bottom pole pieces, which are of like polarity. The disk is caused to rotate by the interaction of the current flowing through it and the magnetic field between the right-hand pole pieces. Both pairs of pole pieces induce eddy currents in the disk, and furnish the necessary drag to make the speed of the meter proportional to the current. However, the variation of mercury friction is such that if the compounding coil were not used the meter would be slower the heavier the load.

The current is passed through the compounding coil in such a direction that, as the current increases, the right-hand (driving) field is strengthened and the left-hand weakened. This makes the driving force greater than it would otherwise be, but leaves the braking force for a given speed unchanged, since both fields contribute to this, and one is strengthened and the other weakened by practically the same amount.

The copper disk is platinum plated and enameled to protect it from the mercury; the edge and center are left unplated, and are amalgamated in order to make good contact with the mercury. The mercury is purified very carefully, a detail which experience has shown to be quite necessary for good results.

The spindle that carries the disk is of nonrusting alloy. The worm is milled in this spindle by a specially designed machine. A steel pivot is inserted at each end of the spindle, each pivot being carried in a replaceable sapphire jewel. The mechanical balance of the rotating system is adjusted by three small nuts, and a weight carried by the spindle causes the whole system to just sink when the mercury is at the normal level. A sealing device, which contains no rubber or other perishable material, is used to prevent escape of mercury when the meter is to be carried about or shipped.

The case is of cast iron enameled inside and out after a careful cleaning to avoid trouble due to iron particles or grit entering the working parts when in service. Substantial cast-iron cases are preferred in England as a rule, and the head of the meter department of a large Italian company expressed his strong preference for such cases because of their ability to stand the rough handling of the class of labor used for carrying meters and placing them in position. The joint between cover and case is made with a gasket, and is said to be dust proof and water-tight. The carrying handle is useful for meters with cast-iron cases; it is a feature that has evidently been considered unnecessary by American manufacturers. Above 50 amperes shunted meters are used. Special cases are used having a compartment at the back for the shunt, so that the whole is self-contained.

CYCLOMETER DIALS.

While some forms of cyclometer dials have been found to be open to serious objection, Messrs. Ferranti consider the type made by them fully as reliable as the clock dial. The early cyclometer dials were, as the name indicates, simply adaptations of the familiar bicycle cyclometer. They had the defect of putting a variable friction load on the meter that became greater as more and more numbers had to be moved; as the higher wheels were idle for long periods, opportunity for corrosion and sticking was present. The friction to be overcome in turning several numbers at once is said to have been at times great enough to stop the meter. Such a dial mechanism is still used by some makers, but is especially objectionable in view of the reduced current consumption of metal filament as compared with carbon lamps.

The firm states that the patent device used in its cyclometer avoids this difficulty. A weight, partly counterbalanced, is carried on the spindle immediately over the number hole farthest to the right. This weight is slowly raised by the revolution of the spindle until it is just

past its top position, when it falls suddenly, changing the figures definitely from one reading to another reading one unit higher. The weight is sufficient to change all the figures at once.

To facilitate testing, a small circle and pointer are provided on the dial, each division being one-tenth of a unit shown by the lowest number wheel, and a similar dial, with white figures on a black ground, is arranged above the dial, each division being one one-hundredth of a unit of the lowest number wheel.

While the writer agrees in general with the ideas which have governed United States practice of late, namely, that meter dials should, for ordinary house sizes, read kilowatt-hours on the lowest dial instead of tenths as in the past, and that dials should be kept free from everything unnecessary that may distract the attention or cause error, he has always held that from the consumer's point of view a meter test by disk revolutions alone is not complete, but needs to be supplemented by a check of the gearing ratio between the spindle and the lowest dial. This usually requires removing the dial from the meter, which gives opportunity for accidents to worm wheel or meter spindle. It might be well for American makers to consider the desirability of providing a tenths or hundredths dial to be used for testing purposes; to make this dial inconspicuous, it could be carried above the regular dial front, as is done in the Ferranti meter.

VARIOUS TYPES OF METERS.

The three-wire direct-current meter consists of two regular two-wire meter mechanisms contained in a single case, each indicating on separate dials. These are made in sizes up to 150 amperes. The battery meter is similar to the three-wire meter, but has each element provided with a pawl to prevent backward rotation. One element indicates the total charge given to the battery, the other the total discharge.

The two-rate direct-current meter has the usual operating element, but with a double set of dials. An electromagnet is used to throw into gear the upper or the lower dial; this magnet is wound with fine wire and connected, with a suitable resistance, in a shunt circuit across the line. A time switch is used to close this circuit during the part of the 24 hours that the high rate is in effect. This time switch may be used to operate the magnets of a number of meters. The shunt circuit of each meter requires about 17 milliamperes; this is flowing only during the time the high rate is in effect.

Prepayment meters are made for direct and also for alternating current. The meter element is of the standard type, and shows the total consumption on the usual cyclometer dial. The prepayment dial shows the total coins deposited up to 999, and the coins unused up to 12. The knife switch has a quick double break with an arcing distance of $1\frac{1}{4}$ inches. The customer in rotating the handle to introduce the first coin closes the switch and also raises a weight that is later released by the meter and opens the switch. The meter acts on the release action through a train of wheels geared down 55 to 1 to reduce the frictional load on the meter. These meters are made in 3, 5, and 10 ampere ranges, the weight being 25 pounds.

The traction meter is a modification of the regular direct-current type, the changes introduced being as follows: The bottom jewel is spring-supported; an ordinary bearing is used at the upper end of the

spindle in place of the usual jewel; the pivots are stronger, and the bottom one is rounded to a larger radius; the rotor is very light, and the meter is heavily shunted. It is said to be capable of standing 100 per cent overload for 10 minutes, and is guaranteed accurate within $2\frac{1}{2}$ per cent from 10 per cent to full load.

INDUCTION METERS.

Before describing the modern induction meter, the manufacture of which has recently been taken up by the company, it will be of interest to describe the older form, which is still manufactured and of which many thousands are in service.

The series winding, wound in four coils on a cast-iron stator, is at the top; below this are shown the mild-steel shunt core with two cast-iron polar projections, the shunt coil, and a cast-iron tube with screw for holding the shunt core in place. The use of cast iron and solid steel for these portions of an alternating-current meter is rather startling to one who is accustomed to the more common practice of using laminated magnetic circuits; in spite of this, the performance, as given by the maker's curves, is a good one. The torque is given as 20 millimeter-grams, and the weight of moving element 23 grams. The full-load speed (for all capacities) is 40 revolutions per minute. The case is of cast iron, as in the direct-current meter; the weight is 15 pounds for sizes from 3 amperes to 25 amperes, inclusive, and 18.5 pounds for 50 to 100 amperes, inclusive. These figures refer to meters for voltages not over 250. The same type is also made as a three-wire meter, the current winding having two strands. The shunt loss of the preceding meters is given as 2 watts for voltages up to 250 and 4 watts above this to 500 volts, both at 50 cycles. The drop in series coil of the 10-ampere single-phase meter is given as 0.15 volt, and inversely proportional to the current for other sizes between 3 amperes and 25 amperes; above 25 amperes the drop is somewhat greater than this formula would give. The starting current is given as about 1 per cent for 3 and 5 ampere sizes, 0.5 per cent for 10 to 25 ampere, inclusive, and 0.25 per cent for 50 to 100 ampere meters, inclusive.

The polyphase meter has two driving elements, as just described, working at diametrically opposite positions on a larger aluminum disk. The moving system weighs 45 grams, and the torque is given as 70 millimeter-grams. The speed with both elements at full load is 40 revolutions per minute. The figures given for shunt loss and series coil drop of single-phase meters apply, with the proper modifications, to polyphase meters. The weight of the latter, voltages not exceeding 250, is 24.5 pounds from 3 to 25 amperes, inclusive, and 28.5 pounds for 50, 75, and 100 amperes, inclusive.

The Ferranti "Type C" induction watt-hour meters embody the features of construction and operation that characterize modern induction meters. The disk is of aluminum, and the full-load speed is low—40 revolutions per minute. The full-load torque is given as 50 millimeter-grams, and the weight of the moving element is 27 grams. The shunt loss is given as 1.5 watts; series loss up to 25 amperes capacity, 1 watt; the starting current of the 5-ampere size, 0.03 ampere. The weight up to 25 amperes capacity is 10.5 pounds with sheet-steel cover, or 11 pounds with glass covers.

The company obtains its supplies and materials from England, France, and Germany and markets its products all over the world, with the exception of the United States, where the high tariff makes competition with American products impossible.

ROBERT W. PAUL.

BUILDINGS AND EQUIPMENT.

The Newton Avenue works of Robert W. Paul are located at New Southgate, one of the northern suburbs of London. The business was established in the city of London by Mr. Paul in 1891, and the present works were erected in 1902-3.

There are four buildings in all, with a total floor space of about 20,000 square feet. All are of brick, and were planned especially for instrument manufacture. One two-story portion of the main building contains, on the ground floor, the drawing and other offices, store-rooms for materials and finished apparatus, and the room where apparatus is inspected before shipment. The floor above is divided into five rooms, which are equipped for the winding of galvanometer coils and of resistance coils, and for the testing and adjustment of resistance apparatus, galvanometers, millivoltmeters, inductance apparatus, etc. The other two-story portion of the main building contains the power plant and storage batteries. The prime mover is a gas engine operated on producer gas; it drives the machine shop by means of a line shaft, and also two direct-current dynamos used for battery charging. In addition to a battery giving a usual lighting voltage, several large cells are provided for heavy currents at low voltages, a special low-voltage generator being provided for charging them. A motor-generator set is provided for supplying alternating currents, and may be operated from the engine-driven generator, or, when steadiness is essential, from the storage battery.

The one-story portion of the main building is the main workshop; it has a saw-toothed roof. The equipment includes, in addition to the usual bench and engine lathes, turret lathes, milling machines, drills, sheet-metal working tools, and machines for grinding, gear cutting, engraving, etc. Included in the above are several machines of American make.

An interesting feature of the assembly benches in the main workshop is the provision for securing increased bench room at times by swinging unused bench lathes back against the wall. The counter-shaft for each lathe is on the top of the bench close to the wall; it has a cast-iron arm that swings in a vertical plane perpendicular to the wall, about the axis of rotation of the shaft, and carries the lathe at its outer end. Thus the lathe may be swung back at any time without removing the belt or changing its tension. Opposite the assembly benches are the lighter engine lathes, small drills, milling machines, and shapers.

A complete duplicate set of standard samples is kept on the racks in the drawing office, where they are often referred to in designing new apparatus. One sample of each pair has a red tag attached. This sample is available for mailing to makers of standard parts, for quotation, or for supply. The other sample bears a green tag and is not allowed to leave the works.

CARD SYSTEM.

The foreman's order form is $8\frac{1}{2}$ by 10 inches, so that when folded it is practically the same size as the 5 by 8 inch daywork and piecework tickets, which are returned to the office with the order, on completion of the work, and filed by number in a folder. These tickets are printed on card stock and are distinguished by color, the daywork ticket being light green and the piecework ticket pink. The totals of the tickets for each workman are entered by him on an 8 by 10 inch white sheet, which is the same on both sides, so that one sheet serves for two weeks.

The net results of the preceding records, namely, the labor costs for lots of parts as made at different times, are recorded on a loose-leaf form that is inserted in a book of costs. This is printed on white paper $8\frac{1}{2}$ by $10\frac{1}{2}$ inches, on one side only. The cost of materials and standard parts purchased from outside sources is entered on a corresponding form. On receipt of a customer's order the office issues a requisition for each instrument on a card 5 by 8 inches, blue in color, and printed on one side.

Many of the parts stored are kept on shelves in boxes, of which there are two sizes, one twice the width of the other. Each space on the shelf for these boxes accommodates two large or four small, or one large and two small, boxes; this plan avoids waste space.

TESTING MICROAMMETERS.

A labor-saving device is used for calibrating microammeters, which are an important product at these works. A special dial rheostat has its resistance so adjusted that when a certain standard amount of additional resistance is in series with it, and an electromotive force of 0.1 volt is applied to the resulting circuit, currents of five, ten, fifteen, etc., hundred-thousandths of an ampere will flow for the successive positions of the dial. The current is supplied by a small storage cell, the dial rheostat and external resistance being tapped off from about one-twentieth of a resistance connected across the cell. A simple one-point potentiometer arrangement enables the standard drop of 0.1 volt to be maintained by the occasional adjustment of a slide rheostat. The value of the external resistance used in series with the dial rheostat is greater than the resistance of any microammeter to be tested, and hence the external resistance may be reduced by an amount equal to the resistance of the particular microammeter under test. Therefore no error is caused by the resistance of the microammeter. This arrangement may be extended, when the nature of the product demands it, by having other points on the potentiometer arrangement, so that standard potential drops of higher or lower values might be had and checked against the standard cell.

MAGNETIC PURITY OF MATERIALS.

For testing the magnetic purity of samples of insulated wire, coil frames, and fittings, as used in the construction of galvanometers, an apparatus is used based on a similar apparatus described by Madame Curie. This apparatus contains a long phosphor-bronze suspension strip, as used in moving-coil galvanometers. The lower end of the

strip carries a horizontal "boom," consisting of a brass wire about 8 inches long. One end of the boom carries a sector-shaped sheet of copper, which moves in the jaws of a strong damping magnet; the sample of material to be tested is hung from the other end of the boom, being slid along to such a position as will make it balance the weight of the damping disk and bring the boom to the horizontal position. A second damping magnet, with vertical air gap, is brought into position so that the sample under test hangs freely in the gap. This second magnet is carried on a support that is pivoted at a point below the suspension and in line with the latter; the support may be slowly rotated from without, when the glass sides of the case are in place to screen the system from air currents. If there are magnetic impurities in the sample, it will be dragged along by the magnet field until the torque of the twisted suspension is greater than that due to the magnetic attraction, when the coil will swing free from the magnetic field. A galvanometer mirror is carried on the suspension; by means of a lamp and scale, the magnitude of the deflection from the initial position may be read. It is not necessary to reduce the result to absolute units of any sort, as the relative behavior of various lots of materials and the permissible limit of magnetic impurity may be determined by experience.

SPECIAL APPARATUS FOR MAKING INSTRUMENT SCALES.

All instrument scales are specially made to suit the individual instruments. To do this work accurately and quickly, Mr. Paul devised and built special apparatus. This consists of two principal mechanisms. The instrument to be "scaled" is placed in the first one, and as the successive values of current are passed through it a radial arm (pivoted to rotate about a vertical line passing through the axis of rotation of the coil) is swung around so that the image of the instrument pointer is brought under the cross wire of a reading microscope carried on the radial arm. A stylus carried at the end of the radial arm is then depressed, making a pinhole in a paper chart; these pinholes are on an arc of a circle several times as large as the arc described by the end of the instrument pointer. By repeating this operation a chart is obtained which is really a scale to fit the law of the instrument, but magnified several times. This chart is marked with the serial number of the instrument and the range and figuring desired and sent to the scale-making room. Here it is put in the proper position in the second apparatus, which has a pointer carried at the end of a radial arm swinging about a pivot. A blank scale cemented to its supporting plate is then put under the radial arm, guide pins bringing it into the correct position. The radial arm carries a printing attachment, which may be provided with type for printing lines of various weights. The printing attachment is self-inking and automatically makes the changes in length of the fifth and tenth division lines. It is also possible to print either horizontal or vertical scales.

LABOR CONDITIONS.

The number of employees is about 85, of whom about 10 per cent are girls. These latter do the coil winding, scale making, and similar

lighter work. The number of hours per week is 50 for the workshop, 44 to 48 for the testing department, and 48 for apprentices, who are allowed time off to attend evening classes. The average rate of pay for daywork is, for journeyman instrument makers, 18 to 20 cents per hour; for piecework, 24 to 28 cents per hour. No trouble from strikes has been experienced.

TYPES OF RESISTANCE APPARATUS MANUFACTURED.

The types of resistance apparatus made by Mr. Paul include single-value standards, dial and plug boxes, Wheatstone and slide-wire bridges. Single standards of Reichsanstalt type are wound with manganin wire. The Drysdale compensated resistance standard is made with the object of securing great permanency combined with small temperature coefficient. With the first-named requirement in mind, all perishable organic substances (silk and varnish) commonly used in such standards have been avoided by the use of bare wire wound on porcelain supports. (A similar construction was proposed by Prof. F. W. Burstall and is described in the Proceedings of the Physical Society of London, vol. 14, p. 286.) To secure the smallest possible temperature coefficient a constantan wire, whose resistance decreases slightly with increasing temperature, is plated with such a coating of nickel (whose resistance increases with increasing temperature) as will most nearly compensate the two opposing effects. If both metals had a linear variation of resistance with temperature it would be theoretically possible to secure perfect compensation. As both constantan and nickel depart somewhat from a linear variation (in opposite directions), this is not possible.

These coils are listed by Mr. Paul in three denominations, namely, 1, 10, and 100 ohms. A question that will naturally arise is, Will not such coils be more troublesome to work with than manganin coils, on account of the large thermal electromotive force of constantan in contact with copper? For the 10 and 100 ohm coils this would probably not be of consequence; for 1-ohm coils and lower values it would seem possible to apply the same principle by nickel-plating manganin which has been selected for negative temperature coefficient. This would avoid the thermoelectric difficulty. (The temperature of manganin is commonly given as positive, but varies considerably in different samples, and is sometimes negative. The temperature coefficient of a sample of manganin may be appreciably changed by annealing it.)

For resistance substandards of 0.1 per cent accuracy, and for standard types of plug and dial decade resistance boxes and bridges, Mr. Paul uses eureka alloy, though manganin is supplied if required, at an extra cost.

The "precision decade resistance," made according to designs of A. C. Jolley, is an arrangement of manganin coils in a metal case for oil immersion, with some novel features of construction. The coils are wound on large brass tubes slit lengthwise to insure a certain amount of yielding, and covered with thin micanite tubes in place of the usual silk. Each decade of coils is mounted in a metal framework, with mica-insulated segments on the upper surface. This dial has the coils soldered to the segments and may be lifted out as no

connecting wires are used between the dials. Instead, a laminated copper brush is pivoted, to make yielding contact, one end with the central ring of one decade, the other end with the segments of the next decade. Each dial is rotated by a crank, the set of coils revolving under the fixed brush. Because of the large size of the coils, and the oil cooling, these coils will carry considerably greater currents than the usual small air-cooled coils. A click device is used to indicate to the sense of touch when the dial is central in each contact position.

Another line of decade boxes and bridges has stationary coils of eureka wire wound on porcelain spools, the coils being proportioned to give low capacity and inductance. (The 10-ohm coil of this type is stated to have a resultant inductance of 3×10^{-7} henry.) There are no live metal parts on the rubber top except the binding posts; the brushes and contacts are thus protected from dirt, and leakage is avoided.

In another line of resistance boxes plug contacts are used, the blocks being molded in the hard-rubber top, so that the surfaces of blocks and top practically coincide. This construction is used to prevent shifting of the blocks, which sometimes occurs where the blocks are screwed and pinned on the top. The insulation resistance between adjacent blocks is stated to be 10,000 megohms.

Carbonized-cloth regulating rheostats, carbon-plate rheostats, rheostats for arc lamps, and other types are made for currents ranging from 1 to 500 amperes.

UNIPIVOT INSTRUMENTS.

The best-known instrument of Mr. Paul's manufacture is probably the "unipivot," made in both moving-coil (permanent-magnet) type and electro-dynamometer type. The distinguishing feature of these instruments is the use of a circular coil supported on a single pivot, the point of which is at the geometric center of the coil, and also at the center of gravity of the moving system. This construction allows the coil to swing freely without touching the core or pole pieces, and is said to give much less friction than the usual two-pivot construction; it also permits the raising of the pivot from the jewel for transportation. By using relatively light springs, the current sensitiveness of the unipivot instruments is made quite large; for example, a 350-ohm instrument with 150-division scale about 7 inches in length gives five divisions deflection per microampere; the time required for the index to come to rest, after closing the circuit, being about five seconds. If reduced sensitiveness is permissible, with a given coil resistance, the time can be reduced by using a stronger spring. The 10-ohm galvanometer of the same pattern as the preceding gives one division for 2 microamperes, or 20 microvolts on the coil. Unipivot galvanometers have printed scales, and are not adjusted to any exact value of current (or voltage) per division. Similar instruments are made with calibrated scales, as millivoltmeters, milliammeters, insulation meters, "universal sets" for measuring practically all direct-current quantities, and pyrometer indicators; the last are also made in horizontal edgewise pattern for mounting on walls. The "Ampall" is a portable unipivot moving-coil instrument giving full-scale deflection for 2 millivolts; a contact block is provided which

has two potential points spaced at such a distance as will give a drop of 2 millivolts on a copper conductor 1 square inch in cross section carrying 1,000 amperes; the scale is figured from 0 to 1,000, and is thus direct reading for such a conductor. With smaller or larger conductors, the reading multiplied by the cross section of the conductor gives the current; this calculation may be quickly made by a circular slide rule supplied with the instrument. The same instrument may be used for conductivity tests, using a 20-microhm copper resistance forming part of the outfit.

Unipivot dynamometer instruments have the moving coil and pivot construction as in the permanent-magnet type. The moving coil is inclosed by the fixed coils. These instruments are made as milliammeters, giving full scale deflection for 20, 50, 100, or 1,000 milliamperes. With the addition of series resistance (free from inductance and capacity) these dynamometers are made as voltmeters, with resistance of 50 ohms per volt. Wattmeters are made on the same principle, the special feature being the low ranges possible.

HIGH-FREQUENCY AMMETER AND GALVANOMETER.

The Fleming high-frequency ammeter, as made by Mr. Paul, consists of a permanent-magnet unipivot instrument connected by flexible leads to a fine iron-eureka thermocouple which is located at the center of a copper wire carrying the current to be measured, or, if the latter exceeds 2.5 amperes, a portion of the current. The high-frequency galvanometer and the thermomilliammeter operate on the same principle; in the former, two wires (one iron, one eureka) are looped together at their centers, and held in X-form by springs; the high-frequency current to be measured enters on an iron terminal and leaves from a eureka terminal. The heating of the junction sets up an electromotive force in the remaining thermojunction, across which the galvanometer is connected. A current of 1 ampere gives full scale deflection. The thermomilliammeter operates in a similar manner, but the thermojunction is in a vacuum; the ranges made are 0 to 10 and 0 to 20 milliamperes. These thermal instruments may be calibrated on direct current, since the wires carrying the current to be measured are small enough to keep the error from "skin effect" down to an amount negligible in practical work.

POTENTIOMETERS, REFLECTING GALVANOMETER, AND WATTMETERS.

The slide potentiometer made by Mr. Paul is electrically one-dial plus a slide wire. The coils forming the dial are mechanically arranged as two dials, one reading from zero up to about half the range, the other covering the remainder. The cadmium cell is provided for, and the working current may be checked by throwing over a double-pole switch, regardless of the dial and slide-wire positions. The long-range potentiometer, designed by Mr. S. W. Melsom is electrically equivalent to one dial of 150 1-ohm coils plus a slide wire, but the 150 coils are mechanically distributed over a number of dials. The thermoelectric potentiometer (Carpenter-Stansfield) has two dials, the remaining figures of the result being read on the galvanometer scale.

Paul reflecting galvanometers are of the Ayrton-Mather type, and have a closed auxiliary damping winding in addition to the main coil.

By opening the damping circuit the galvanometer may be made ready for ballistic work. The Campbell standard galvanometer is a moving-coil instrument for use as a precision ammeter or voltmeter in connection with suitable shunts and series resistances. To avoid spring fatigue, a wide bifilar suspension is used. The deflections are read by lamp or telescope and scale.

The Duddell-Mather standard wattmeter is a torsion-head instrument designed to avoid sources of error as far as possible. It is an astatic instrument, with stranded fixed coils that may be connected in various groupings to secure a wide total range. Metal parts are avoided to prevent eddy current errors; air damping is used. The design is such that full scale deflection can be, without overloading the coils, at power factor 0.1. For use in the potential circuit of this wattmeter, an oil-immersed series resistance of the Duddell-Mather "gauze" type is used. This "gauze" is a fabric 7.5 inches wide, made of silk-covered eureka wire woven with silk threads. The construction gives low capacity and inductance, high insulation, and large cooling surface. A suitable length of the gauze is supported on porcelain insulators.

INDUCTANCE APPARATUS—THERMOCOUPLES.

Inductance apparatus made by Mr. Paul includes the Campbell variable mutual inductance; fixed self and mutual inductance standards; the Campbell "microphone hummer" for supplying small currents at 800, 1,000, 2,000, or 3,000 cycles; and the Campbell vibration galvanometer.

In addition to the pivoted and sector patterns of the Ayrton-Mather electrostatic voltmeters Mr. Paul makes Ayrton-Mather reflecting electrostatic voltmeters, with range of 1 to 9 or 4 to 30 volts; also a torsion-head pattern with range up to 60 volts.

Paul thermocouples are made with a rod of eureka alloy inclosed in an iron tube and insulated from the tube by steatite and magnesia, except at the end, where the iron and eureka are welded together to form the thermojunction. These are for use up to 900°C .; above this temperature, up to $1,600^{\circ}\text{C}$., a couple is used that consists of two wires of platinum-rhodium alloys of different percentages. These couples are said to be more durable and less liable to contamination than platinum-iridium couples. Unipivot indicators are used; for comparatively low ranges the indicator is fitted with the Darling compensator. This consists of a bar formed of two dissimilar metals, as used in thermostats and metallic thermometers, which is arranged to shift the zero reading of the indicator with changing room temperature, by an amount such as will correct for the varying temperature of the "cold junction." Apparatus is also made for temperature measurement by the electrical resistance method, using the Harris direct-reading indicator. The latter is a permanent-magnet moving-coil ohmmeter, whose construction is such that moderate variations in the working current produce no perceptible effect on the readings; it may be operated by a 4-volt storage battery or from a direct-current lighting circuit. It is electrically equivalent to a differential galvanometer with a third winding at right angles to the other two, the third winding providing the controlling force.

HOT-WIRE OSCILLOGRAPH.

The Irwin hot-wire oscillograph is about the last application that one would expect to make of the hot-wire principle, as hot-wire instruments are notably sluggish in coming up to final reading for a given current. The results obtained are remarkable. (Journal of the Institution of Electrical Engineers (London), vol. 39, p. 617; 1907.) The principle of the instrument consists in using two fine wires under tension, carrying a light mirror; the wires are polarized by passing a direct current through them. The alternating current is then superposed on the direct, so that at any moment the direct current in one wire is increased and that in the other decreased. The mirror will thus be deflected to one side, the deflection being practically proportional to the instantaneous value of the current, neglecting thermal lag. The natural sluggishness of the hot wire, due to heat capacity, is overcome by distorting the current wave. For example, in using the hot-wire element in series with a high resistance to get the form of a voltage wave, a condenser is shunted around a part of the resistance. In order that the oscillograph shall give the true form of the voltage wave, the product of the capacity of the condenser and the resistance around which it is shunted must equal a constant, which depends on the heat capacity of the wires and their rate of losing heat.

Mr. Paul secures his materials almost entirely from English sources; he stated that American dealers did not offer to supply him. His products are marketed throughout the world. While the high tariff tends to limit sales in the United States, he confidently expects to increase his sales there.

NALDER BROS. & THOMPSON (LTD.).**ORGANIZATION, BUILDINGS, AND EQUIPMENT.**

The firm of Nalder Bros. & Thompson (Ltd.) was established by F. H. Nalder and H. Nalder in 1884 as Nalder Bros. C. W. S. Crawley joined them in 1886, the name of the firm being changed to Nalder Bros. & Co. Alfred Soames also joined the firm a little later. In 1896, the business having increased greatly, it was divided; the ammeter, voltmeter, and switchboard business was taken over by F. H. Nalder and E. Thompson under the name of Nalder Bros. & Thompson. In 1899 the business was converted into a limited liability company, and an additional factory building was secured at Dalston, in the northern part of London.

The principal office is located at 34 Queen Street, in the east-central district of London. Here also the work of coil winding, assembly, and testing of instruments is carried on, the work occupying several floors of the building. The factory at Dalston produces parts for stock, which are assembled at the Queen Street works. The Dalston factory is a three-story brick building, and is well-equipped with machine tools, including full-automatic screw machines, ordinary turret lathes, engine lathes, milling machines, tapping machines, grinders, and drills. Included in the above are machines by Brown & Sharpe; Pratt & Whitney; Cincinnati Milling Machine Co.; Brainard Milling Machine Co.; Dwight Slate Machine Co.; Washburn Shops of the Worcester Polytechnic Institute; Hendey Machine Co.; and other American firms. The machines are driven by a gas engine through

the usual line and countershafting. The exhaust from this engine is carried up to the top floor and used to heat the plating baths before it escapes into the atmosphere. Gas furnaces are used for hardening, tempering, melting solder, etc. The temperatures for hardening and tempering magnets are determined by thermocouple and millivoltmeter. After being magnetized, the magnets are artificially aged and also numbered, tested, and marked with the strength, in arbitrary shop units. They are then stored for a period of time and again tested before assembly; this is done to prevent the use of magnets liable to change after assembly.

An interesting method of speed variation is used in the coil-winding machines at the Queen Street works. The spindle carrying the coil to be wound is driven by a small pulley, which is in contact with a special friction disk mounted on the shaft of an ordinary fan motor from which the blades have been removed. The friction disk has a spherical surface, whose center is in a vertical line through the center of the base of the motor; the motor is arranged to swivel about this vertical axis by pressure on a treadle. The arrangement is similar to that used in friction disk drills; it enables quick control of the speed of the winding over the whole range from zero to maximum.

All instrument coils are dried in a vacuum, using an incandescent lamp as a heating element in the vacuum chamber. This practice has been followed by the firm since about 1888.

For alternating-current testing two alternators are driven by a direct-current motor. By varying the size of the driven pulley frequencies from 25 to 100 can be obtained. Kelvin balances and Siemens electro-dynamometers are used as standards for alternating-current testing. For the measurement of high voltages an arrangement due to Ayrton and Mather is used, consisting of a large number of coils in series, forming a high-resistance "volt box." Around a portion of this resistance is connected an electrostatic voltmeter reading up to 2,000 volts. The coils composing the high resistance are mounted in a frame in such a way as to give high insulation and dielectric strength; taps are brought out at intervals, so that for various values of voltage applied to the total resistance, approximately full-scale deflection of the electrostatic voltmeter will be produced. The maximum current in the resistance coils is about 0.01 ampere. The maximum voltage measureable with this apparatus is 40,000; it is used for testing potential transformers and high-range electrostatic voltmeters.

For direct-current testing the potentiometer is used as ultimate standard, and portable instruments compared at intervals with the potentiometer are used as working standards.

CONDITIONS OF LABOR—PRODUCTS OF THE FIRM.

The number of employees is about 180; of these, about 15 to 20 per cent are girls. The hours of work are from 8 a. m. to 6.30 p. m. (with an hour for lunch at noon), except Saturday, when the works close at 1 o'clock.

The products of the firm include circuit breakers, switchboard and portable instruments, and instrument transformers.

Permanent-magnet moving-coil instruments for switchboard use are made in four sizes of round pattern, with dials from 5 to 11 inches

in diameter and bases 6 to 12 inches in diameter. They are also made in four sizes of sector pattern, with scales 5 to 12 inches long, in addition to two older patterns still called for. The largest sector instrument has two movements astatically arranged; this construction reduces error due to stray magnetic fields and would seem to be very suitable for voltmeters. A number of forms of edgewise instruments are also supplied. Ammeter shunt leads are provided at the shunt ends with strips of alloy several inches in length of the same material as is used for the shunts. The purpose of these strips is indicated by the name applied to them, "counterthermal electromotive force ends." Two types of portable moving-coil instruments are made: A "portable standard," with enameled metal cases of the sector form, and a "portable" at a lower price, in wooden case. Testing sets are also made, one form having a multirange voltmeter and a millivoltmeter, the two movements being mounted in one case, and shunts being provided to give three or four ranges; the other form consists of a single moving-coil instrument provided with a change-over switch to enable it to serve either as a voltmeter or as a millivoltmeter with shunts.

Soft-iron instruments are made on the repulsion principle, the iron used being specially treated to reduce hysteresis errors. This line includes two sizes of round pattern in iron cases, a smaller "gauge type" round pattern for use with motors, and a round-pattern instrument with a 3-inch dial. All the preceding are air-damped and are listed with gravity control, though spring control is supplied at an extra cost. Several sizes of round-pattern instruments in brass cases are still made to meet a demand for this form; these have gravity control and are undamped unless otherwise ordered. In addition, soft-iron instruments are made in several sizes of sector and of edgewise pattern, and also in the horizontal edgewise pattern familiar in the United States.

SWITCHBOARD VOLTMETERS—ELECTROSTATIC VOLTMETERS.

A switchboard wattmeter (round pattern, 8-inch dial, 9.5-inch base) is made by the firm after designs by Dr. C. V. Drysdale. It differs from the usual forms in having a laminated iron magnetic circuit, around which is wound the series coil; the potential coil swings in a gap in the magnetic circuit. The use of iron greatly increases the torque, and thus makes possible the use of stronger control springs. It is stated that the instruments are accurate on low-power factors and are free from error due to variation in frequency and wave form; also, that they are suitable for use with direct current, the hysteresis error being said to be practically negligible. These wattmeters have magnetic damping.

Electrostatic voltmeters for switchboard use are made with pivoted moving element, in round-pattern brass cases, with upper limits of 1,200 to 6,500 volts. A modified form of somewhat lower cost is made in practically the same ranges, in an iron case. In the brass-case form a neat device is used to make it safe to replace the self-contained fuses without disconnecting the line wires from the terminals. A hard-rubber block is attached to one end of a brass arm, the other end of the arm being hinged to the case. The hard-rubber block carries the terminals to which the line wires are attached;

metallic extensions of these terminals enter insulated openings in the case, near the base, when the hinged arm is pushed down, and make contact with the ends of the removable fuses. By raising the arm the terminals are swung away from the case, and the fuses may be readily replaced.

TYPES OF RECORDING INSTRUMENTS—CURRENT TRANSFORMERS.

Recording instruments are made in the permanent-magnet moving-coil type, and also in the soft-iron type; both types are supplied in switchboard and in portable forms. The soft-iron type for switchboard use must be adjusted for a particular frequency, unless a special compensation for frequency, at extra cost, is ordered; it is stated that this compensation makes the instrument read correctly on any frequency, and also on direct current. All recorders are oil-damped, except portable recording voltmeters. Two forms of chart are used. The single-revolution chart is wound around a cylindrical drum, and must be replaced after one revolution of the latter, which is made in 6, 12, or 24 hours. The continuous-record chart consists of a roll of paper 63 feet long. The drum for the latter has a set of needle points on one side, which drive the paper forward; it is thus unnecessary to perforate one edge of the chart.

Current transformers are made in open type for use on circuits up to 2,500 volts, and in inclosed (oil-immersed) type up to 12,000 volts. The open type has a wound primary coil up to 250 amperes; the bar type is supplied for 300 to 5,000 amperes. The standard secondary full-load current is 5 amperes. Potential transformers of the standard type are rated at 50 watts, 40 cycles, and give 110 volts on the secondary with rated primary voltage. Up to 2,500 volts the open type is supplied; above that, up to 12,000 volts, the oil-immersed type.

Other switchboard instruments made by the firm include ground detectors, moving-coil type, for mine use; round-pattern frequency meters, vibrating-reed type; round-pattern power-factor meters and synchronizers.

THE OHMER—MARKETS.

The ohmer (Cox's patent) is of interest on account of the principle involved. It consists of a pivoted electrostatic instrument whose operating parts consist of four sets of fixed quadrants, each set having 13 vanes, the space between adjacent vanes being about 0.2 inch, and a moving element consisting of 12 fishtail-shaped vanes of mica covered with aluminum. This construction is said to be much better than the one using solid aluminum vanes, the mica being much more elastic and not so readily deformed. A hand magnet generator wound for 500 or 1,000 volts is connected through a high resistance to the terminals to which unknown resistances are to be connected, and each set of fixed quadrants is joined to one end of the high resistance. The moving vane is connected to the commutator brush, which goes directly to one of the unknown terminals. When the resistance between these terminals is infinite there is no fall of potential along the resistance coil to whose ends the two sets of fixed quadrants are joined, so that these sets are at the same potential; the moving element will take up a position such that sym-

metrical portions of it are inclosed by the two sets of fixed quadrants. If the unknown terminals are joined by a wire of negligible resistance, the moving element will have the same potential as one of the fixed elements, and will turn until it is symmetrically inclosed by the other fixed element. For values of resistance across the unknown terminals intermediate between zero and infinity, the moving element will take up intermediate positions, and the scale may be graduated by trial. The upper limits for which the instrument is made are 20, 50, and 100 megohms; each instrument has a switch for shunting the internal resistance down to one-tenth of its value, so as to reduce the range in the same proportion. The 1,000-volt ohmer may be fitted with two vibrating reeds under the window opening of the instrument. One of these reeds will be set in vibration when the speed is that which generates an electromotive force of 500 volts; the other reed responds when the electromotive force is 1,000 volts.

The ohmer is independent of voltage, in principle; in practice this depends upon the ratio of the actuating torque, for a given displacement of the moving element from its true position, to the torque of the flexible conductor used to make connection with the moving element, and also to the frictional torque. The latter is a difficulty in the way of making satisfactory pivoted electrostatic instruments; in the present instrument the ohmmeter and the generator are mounted on the same base, and the vibration transmitted from the generator tends to prevent frictional errors. The prominent advantages of the instrument are the lightness of the electrostatic ohmmeter as compared with permanent-magnet moving-coil ohmmeters, and its independence of stray magnetic fields.

The firm uses British materials almost exclusively. Its product is marketed in Great Britain, Canada, English colonies, and abroad generally, but very little is sold in the United States.

BRITISH USE OF ELECTRICAL SWITCHES.

SALE PRICES AND METHODS OF SELLING.

[From Consul Horace Lee Washington, Liverpool.]

For ordinary house lighting and general purposes the electrical switch in popular use in the Liverpool consular district is the universal tumbler switch, 5 amperes, single pole, 230 volts. These switches are manufactured principally in Birmingham.

There are no electrical switches manufactured in the Liverpool district, the retail trade drawing its supplies from Liverpool wholesale dealers and from wholesale houses in London and Birmingham. The prices, taken from the current catalogue and price list of a Birmingham manufacturer, are as follows: Pattern No. 1, diameter of base $2\frac{1}{2}$ inches, projection 2 inches, carrying capacity 5 amperes, price \$2.92 per dozen; pattern No. 2, diameter of base 3 inches, projection $2\frac{1}{2}$ inches, carrying capacity 10 amperes, price \$6.19 per dozen. There is a trade discount of $33\frac{1}{3}$ per cent.

Push button and rotary switches of foreign manufacture are known and used in small quantities as control switches for a number of 5-ampere switches and for 10-ampere arc lights, and in cases of important work where a more reliable and enduring switch is desired

than the ordinary 5 and 10 ampere-tumbler switch referred to. For heavy work "ironclad" switches are commonly used.

Ninety per cent of the wiring of the interior of houses for electric-light circuits in the city of Liverpool is performed by private firms, the remaining 10 per cent being done by the municipal authority, which alone supplies the electrical energy of the city. Outside of the city and within the consular district the work of wiring is done entirely by private firms.

In some instances the practice of selling electrical supplies direct to the wholesalers is adopted and in others an agency is established in, say, London (which is the leading center for wholesale houses) or Birmingham. In the electrical, as in the large majority of other trades, it is the custom and practice for the retail trade of the country to obtain its supplies from wholesale houses (located principally in London). Those interested state that this system is effective and economical, and that better results are obtained than would be the case if attempts were made to do business otherwise.

An advertising campaign from the United States with circular letters, folders, catalogues, and free samples would, in the opinion of those interested in the trade, prove absolutely useless. Competition in electrical supplies is very keen, manufacturers are very active, and retailers are regularly visited by traveling salesmen.

APPROVAL BY ENGINEERS IS NECESSARY.

[From Consul Benjamin F. Chase, Leeds.]

A prominent electrical engineer of Leeds states that an American make of switches is in very common use here. They are used on almost all of the street cars of the city as well as for private installations both here and in other parts of the consular district, which has other large towns and a population of approximately 2,000,000.

Each city and each power company has its own engineer. He has the complete authority in his section in such matters, whether it be a city, an incorporated borough, or a district supplied by some power company. The only time his authority can be questioned is when he arbitrarily orders a particular make to be used. In that case an appeal can be taken to the Board of Trade, a department of the National Government with headquarters in London, which will appoint a special engineer to pass upon other makes. If approved by this special engineer, apparatus may then be placed in the territory even against the protest of the local engineer.

The first step in getting apparatus introduced is to have it approved by the several engineers. The local engineer will often make a change at the order of the official engineer rather than raise the question by going to the Board of Trade, because he can always furnish the approved pattern at as good a profit as the rejected one. For this reason it is important that the manufacturer get the approval in advance of a campaign to introduce his goods.

American switches and other products are procured here through a London house and also from concerns in Manchester and Leeds. Such goods are sold here through catalogues and no general line is submitted to the buyer. A thorough canvass of this district might be made with samples of the various products and at the same time the canvasser could get the approval of the engineers referred to.

Wiring is practically all done by private contractors. The building contractor often puts in the framework or base of the installation and the balance is then placed by some private electrical engineer.

Factors as a rule buy from the large wholesale houses in London and do not import direct. An agency in the district would likely result in having things pushed. The wholesalers as a rule do not push a particular line. If an American firm has an agency in London it would be advisable to sell through wholesalers, but if it has an agency in the district it would be better to sell to the contractors, etc., direct.

An advertising campaign with circulars, etc., would be advisable, but would be most effective if conducted through a branch in London or some other large city to avoid calling attention too strongly to the nationality of the product. Literature should be addressed to contractors and to corporation (city) and power-company engineers to get their approval, so that the fixtures will be passed when installed.

HOW TRADE MAY BE SECURED IN SCOTLAND.

[From Consul John N. McCunn, Glasgow.]

Wiring is done in this country by private firms and contractors who make a specialty of it. Supply companies have nothing to do with such work. In endeavoring to build up a trade here sales should be made to every one in the electrical line—wholesalers, private firms, and contractors. The last named, however, should not receive so large a discount as the wholesalers.

A good reliable representative would be a great advantage, or a firm already doing business might be induced to take up the agency for the goods and carry a small stock. The representative or agency would deal direct with the wholesalers, contractors, etc. If after a trial it is found that the wholesale firms are not going well, they could be dropped and dealings established with others.

An advertising campaign with circular letters, catalogues, free samples, etc., would be necessary, either from the home office or from the representative or agency in this country. It is not advisable to send samples, however, until inquiries are received. Any letters, folders, or catalogues sent out should be addressed to the various wholesalers, supply companies, and contractors.

There are several large companies in this country that make switches of all descriptions, but there is always room for a good reasonable-priced article. Prices and discounts should always be quoted in English currency. The representative or agent for Great Britain should be located either in Glasgow or in London, the latter being more suitable for the south of England and Glasgow for the whole of Scotland, the north of England, and Ireland. It would be well to appoint an agent who is familiar with the territory and is well known to the trade.

POPULARITY OF THE TUMBLER SWITCH IN ENGLAND.

[From Commercial Agent H. B. Brooks.]

The tumbler switch is very generally used in England and has obtained such a hold through long use that types of switch satisfactory to Americans do not find favor with English users. For example,

in an article published in the London Electrical Times for January 11, 1912, a writer makes the following statement:

Another thing I could not get explained [in America] was the general use of push-button switches. These are not nearly so convenient as tumbler switches, and must be a lot more expensive. Perhaps this item of expense accounts for the fact that even in first-class hotels very few bedrooms have two-way switches, giving control from bedside as well as from doorway.

The tumbler switch has the defect that its make and break is under the operator's control. When such a switch is used for a considerable number of lamps, it is possible for the circuit to be broken slowly, causing an arc to be formed, with resulting damage to the contacts. This slow break may be due to ignorant use of the switch, or to intentional meddling. Switches with break under the operator's control were used in America 25 years ago, but were given up long ago by most if not all American makers in favor of switches whose make and break occur suddenly by spring action, the moving parts then being out of control by the operator.

However, the English practice recognizes the weakness of the tumbler switch by using it for relatively small loads; they are rated as high as 20 amperes, but are ordinarily used for much less. The most common use is for single lamps or fixtures. For branch circuits at distribution panels, a type of switch somewhat similar to the ordinary knife switch is used; these latter are made in sizes from 15 amperes up. For car lighting with lamps in series on 500 volts, the last-named type is used and the rotary snap switch also. This use of the snap switch is virtually an admission of the superiority of its working principle.

A defect of the old type of tumbler switch is that it projects a considerable distance from the wall and is thus exposed to danger when furniture is being moved, etc. This point is being met by the makers, who are bringing out forms having less projection than formerly. The tumbler switch is also made in flush pattern, with various forms of plates.

MAKERS WILLING TO SUPPLY SPECIAL MATERIAL.

English switch makers cater to the varied tastes of their patrons by supplying a variety of styles and finishes. For example, the best London maker shows (for a line of surface-type tumbler switches) five shapes of brass covers, which may be had in regular or any of 15 special finishes; also two types of porcelain covers, which are supplied in either cream color or black. This firm also supplies a large variety of special switches, including one for starting small single-phase motors with auxiliary starting winding.

Manufacturers in England are much more willing to supply special material than are American makers. A request made to the latter for special apparatus or material is likely to be answered by the sending of a catalogue of standard material, with the request that the customer select what will most nearly meet his needs. In England the reverse is true; competition is strong, the extra labor required for getting out special goods is not so expensive, and the customer's good will is regarded as worth striving for.

METHODS OF SECURING ENGLISH TRADE.

An American maker of switches or similar material who wishes to compete in the English market should send a capable representative to England to study the situation and learn the tastes and ideas of the consumers. In preparing advertising matter for England, the English terms should be used. For example, United States "socket" is English "holder"; United States "shade holder" is English "gallery"; United States "attachment plug" is English "adapter"; and so on. The American address and place of manufacture may well be omitted in the advertising matter and the London name and address substituted.

The English public does not adapt itself readily to new situations and new ideas; American makers should learn the likes and dislikes and in the beginning supply what is wanted as nearly as possible rather than undertake at long range the task of introducing standards of performance and taste differing from those now prevailing. With business established it may be possible to introduce other types gradually.

In order to equalize the volume of business and reduce fixed charges, it might be well for several noncompeting American makers to arrange with one competent representative to handle their several specialties under one firm name in London. Such an arrangement would lessen the cost of advertising, correspondence, and many other items.

EXHIBITION OF THE PHYSICAL SOCIETY OF LONDON.

The Physical Society of London held its seventh annual exhibition of electrical, optical, and other physical apparatus in December, 1911. While some of the exhibits were practically the same as at the London Electrical Exhibition of October, there were a number of new ones of importance.

EXHIBITION OF THE CAMBRIDGE SCIENTIFIC INSTRUMENT CO.

The Cambridge Scientific Instrument Co., Chesterton Road, Cambridge, showed an oscillograph for tracing the waves of current and voltage. This instrument is insulated for use on circuits up to 50,000 volts. The Whipple-Féry radiation pyrometer shown by the Cambridge Co. is a modification of the standard Féry pyrometer (used for obtaining temperatures of furnaces, etc.) and can be used where the regular form can not. It consists of an iron tube, at one end of which is a blind tube of fire clay, quartz, steel, or graphite; a mirror is mounted at the other end, and a small thermocouple is located at the focus. In use the blind tube is placed in the furnace or other source of heat; the radiation from the hot end is brought to a focus upon the thermocouple. The latter may be connected to a millivoltmeter, which indicates the temperature, or to a recorder. In using the apparatus, no focusing is necessary.

Another novelty shown by this firm is a recording electrometer, which is intended for use in meteorological investigations. It belongs to the class of instruments in which the moving system swings clear of the chart, except at intervals, when a bar is depressed

and brings the index against the chart. The dots so formed are close enough together to form practically a continuous line.

The Cambridge Co. also showed a portable deflection potentiometer of 40 millivolts range, intended for thermocouple work, the galvanometer reading 3 millivolts each side of the central zero. This type of potentiometer was originated at the United States Bureau of Standards.

HIGH-VACUUM PUMP DISPLAYED BY A. C. COSSOR (LTD.).

Messrs. A. C. Cossor (Ltd.), 54 Farringdon Road, E. C., London, showed Rose's patent high-vacuum pump. This pump has an iron piston in the high-vacuum cylinder and the cylinder is surrounded by a solenoid through which a direct current flows. The solenoid is arranged to move up and down, and so moves the iron piston up and down; piston rod and stuffing box are thus done away with. A low-vacuum pump for producing a preliminary vacuum is mounted on the same base, and is connected in series with the high-vacuum cylinder. This apparatus was developed to produce the high vacuums required by metal-filament lamps, and the makers claim that it is especially suitable for exhausting metal and carbon-filament lamps, X-ray tubes, and vacuum flasks without the use of chemicals. It is stated that tests with a large McCleod gauge have given a vacuum of 0.0000045 millimeter, and that it is about two and a half times as rapid in operation as a mercury pump.

THE FOSTER STRAIN METER.

The Foster Instrument Co. (Letchworth, Herts) showed the Foster strain meter. This is a very simple device that can be applied to determine strains in metal structures; for example, strains in bridges due to the application of live or dead loads; strains in hoists or cranes; strains in vessels during launching, or due to rolling or pitching; and strains in test pieces of iron, steel, etc. The advantages claimed are as follows: Simplicity (it has no microscope), portability (complete outfit weighs 3 pounds), rapidity, accuracy, independence of vibration, and low cost. A feature to be noted is that in using this instrument with test pieces in tension, the instrument suffers no damage if the specimen ruptures under test. Patents on this instrument are pending in countries other than England.

The Foster Co. also showed Hoskins's "base metal" thermocouples for use up to $1,360^{\circ}\text{C}$.—a simple apparatus, designed for industrial laboratory and factory use, for determining the recalescent point of steel samples. This apparatus consists of a Hoskins alloy thermocouple over which the drilled sample is slipped. The temperature is raised by a Bunsen burner, and shown by a portable millivoltmeter graduated to read temperature. On removing the burner the "halt" in the cooling curve may be readily observed.

BEAM PROTECTOR FOR BALANCES—THERMOMETERS—RIBBON METALS—VIBRAGRAPH.

A. Gallencamp & Co. (Ltd.), Finsbury Square, E. C., London, showed Manley's patent beam protector for analytical balances. This device consists of a case surrounding the balance beam, prevent-

ing variations of temperature and consequent inaccuracies. It is intended for scientific research and other work requiring extremely accurate weighing.

John J. Griffin & Sons (Ltd.), Kemble Street, Kingsway, W. C., London, showed "quartz-glass" mercury thermometers for temperatures up to 750° C.

The Ribbon Metals Syndicate, 50 City Road, E. C., London, showed in operation its machines for manufacturing ribbon metals by a continuous casting process. The melted metal is allowed to flow through one or more orifices and strikes a rotating cylinder through which cooling water flows.

Siemens Bros. & Co. (Ltd.), Caxton House, Tothill Street, Westminster, S. W., London, showed the vibragraph, an instrument used to measure the record vibration. It contains a mercury cup, on which floats a mirror. A beam of light from a small incandescent lamp is reflected by the mirror to a ground-glass screen for observation, or to a photographic plate when a record is to be made. One application of this instrument is the securing of a definite measure of vibrations in buildings, in such cases as lawsuits against electric-light and power plants by owners of neighboring buildings. The Siemens Co. also showed tantalum evaporating dishes and tantalum forceps for laboratory use.

QUARTZ GLASS LABORATORY APPARATUS.

The Silica Syndicate (Ltd.), 82 Hatton Garden, E. C., London, showed a very interesting display of "quartz-glass" (fused-quartz) laboratory apparatus, such as basins, beakers, crucibles, flasks, retorts, test tubes, ignition spoons, quartz fiber, etc. The transparency of this ware is very good. The coefficient of expansion of quartz glass is very small as compared with ordinary glass, being considerably under 1 part in 1,000,000 per degree centigrade. There being thus practically no expansion or contraction with change of temperature, a vessel or other object made of quartz glass may be heated red hot and then plunged into cold water without cracking. Quartz glass is said not to be attacked by any of the volatile acids except hydrofluoric acid. Its melting point is given as about 1,600° C. and its density 2.2.



**DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF MANUFACTURES**

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 56

**ENGLISH METHODS OF DYEING
, FINISHING, AND MARKETING
COTTON GOODS**

By

J. M. HAUSE

Commercial Agent of the Department of Commerce and Labor

**TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD**



**WASHINGTON
GOVERNMENT PRINTING OFFICE
1912**

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LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE AND LABOR,

Washington, July 5, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ended June 30, 1912, approved March 4, 1911, a report by Commercial Agent J. M. Hause, of this department, containing the result of his investigations of the English methods of dyeing, finishing, and marketing cotton goods.

Respectfully,

BENJ. S. CABLE,

Acting Secretary.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, May 28, 1912.

SIR: I have the honor to submit herewith a report by Commercial Agent J. M. Hause on the English methods of dyeing, finishing, and marketing cotton goods, which is supplemented with excerpts from that part of the report of the Tariff Board on cotton manufactures dealing with the cost of dyeing and finishing in the United Kingdom.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

To Hon. CHARLES NAGEL,
Secretary of Commerce and Labor.

ENGLISH METHODS OF DYEING, FINISHING, AND MARKETING COTTON GOODS.

MARKETING METHODS.

The cotton industry may be divided, so far as its markets are concerned, into three branches—raw cotton, yarn, and cloth. The raw-cotton and the cloth markets are at each end of the scale, and the yarn market lies between. It is intended in this report to deal with the yarn and cloth markets.

The yarn market is much less developed than the raw-cotton market. It has no published quotations or clearing house like the cotton market, and there is no system of dealing in futures, the reason for which is that yarn is much less easily graded than raw cotton. Differences in mixing, cleaning, carding, drawing, and spinning all tend to obscure the standard grades, so that although there has been for many years a rough attempt at grading, many important differences may be found in yarns of one grade. Manufacturers therefore buy, not 36s twist, but some particular firm's 36s. It will be seen how variations in the quality of yarn prevent there being a futures market.

Transactions between spinners and weavers are conducted on the yarn market by yarn agents, but there is no special division of these agents into buying brokers and selling brokers as in the raw-cotton market. The yarn agent works for the spinner and sells on commission; the spinner knows the name of the manufacturer and takes all risks. In many cases, of course, yarn agents become principals and some of the wealthier firms have many representatives on the exchange, and being rich and influential are able to finance either the spinner or the manufacturer as the case may be. It is a noticeable feature of the yarn market that no combined price list is issued; it is clearly impossible to get the firms to publish their prices.

PECULIARITIES OF THE CLOTH MARKET.

The cloth market presents the same difficulties as the yarn market, in fact, is even less highly developed. It is easy to see why this should be so, for the cloth market contains all the difficulties existing in the yarn market plus the great number that tend to accrue in the weaving. Still so necessary is it for the easy working of the market that there has been some rough classification, which serves as an index to quality rather than a description of it. Although the cloth market is less highly developed than other markets in the cotton trade, yet, in comparison with ordinary commercial markets, there

is at least greater subdivision. It is a common thing for manufacturers in other lines who are doing a foreign trade to make direct transactions with importers in the country concerned, but in the cloth market this very rarely happens. Cotton goods are, of course, sold mostly abroad, and with few exceptions the whole of this foreign business is in the hands of shipping firms. Only in exceptional cases does the Lancashire manufacturer offer to sell his goods in markets other than Manchester. Moreover, the selling is a specialized business and the merchants themselves are sharply divided into home and foreign merchants, the latter being known as "shippers." In rare instances Lancashire manufacturers do their own marketing abroad, and special classes of goods are produced upon which they depend to keep their trade.

The difference between the cotton trade and other trades in this respect appears to lie in the quality of the manufactures. If the commodities produced are in universal demand, are easily understood, and can be more or less graded, the business of selling tends to remain in the hands of the merchants; but if the commodity needs to be explained to buyers by expert salesmen, manufacturers themselves commonly attempt to reach the consumers. An example of this is textile machinery, which is generally sold direct to the owner of the mill through a representative of the manufacturer.

CONCENTRATION OF INDUSTRY—MANCHESTER'S UNIQUE POSITION.

Much has been said from time to time about the lack of enterprise among the British houses in not sending out more travelers. It should be borne in mind, however, that English trade connections were built up years before England's competitors became interested in foreign trade. It is this great advantage Lancashire has had in the concentration of the cotton trade that has led foreign merchants to establish offices in Manchester. There is therefore the less reason for enterprise on the part of English manufacturers in sending out travelers when the firms on whom their travelers would call have representatives in Manchester who can be seen every day on the exchange. This is part of the great centralization of the cotton industry. A merchant in the Levant or in India or China who sold cotton goods found it easier to establish a buying house in Manchester where he was sure to see almost all the cotton goods that were offering in his market. Had he been a buyer and seller of machinery instead of a buyer of cotton goods he would have had to establish offices in other countries to be sure he was drawing on all the available sources of supply.

Manchester occupies a unique position in the textile business of the world. There is probably no parallel to the Manchester system, under which foreign merchants reside in the place of manufacture in order to obtain their goods in the best possible condition, and certainly no better system could be imagined for a great export trade than the one outlined.

These are a few of the outstanding features of the Manchester cloth market. The great advantage of centralization can not be overestimated. The proximity of all the textile industries enables the shipper who has a cable from abroad to order from the manufac-

turer's agent who is within a few yards of his principal. The manufacturer in turn can see the yarn agent about the yarn, and the spinner who is making the yarn can secure the raw cotton on which all prices are based.

RELATIONS OF MANUFACTURER AND SHIPPER—CONTRACTS.

In considering the transactions between manufacturer and shipper one finds a still less specialized market, with the agent holding a correspondingly less secure position. It is not uncommon for a shipper to deal direct with the manufacturer, and to get from him the ordinary discount and the agent's commission as well. The shipper buying from the agent gets $2\frac{1}{2}$ per cent discount, but he is frequently able to buy from a manufacturer and get $2\frac{1}{2}$ per cent plus the $1\frac{1}{2}$ per cent that would be the agent's commission.

The conditions of sale vary from time to time; a copy of perhaps the best-known Indian contract—the Karachi contract—is forwarded [and may be had by applying to the Bureau of Manufactures].

In this contract a number of obligations are imposed on the shipper, some of which are extremely serious. For example, clauses 8, 9, and 10 deal with the question of late delivery, and the buyer has the power, if the goods are late, of canceling without any allowance, or of accepting the goods under an agreed allowance of $1\frac{1}{2}$ per cent in the case of one month and $3\frac{1}{2}$ per cent if the delay exceeds three months. Clause 15, dealing with the question of disputes, is also important and is not the same in all agreements. In this particular agreement two European merchants are mentioned, but it is by no means usual for both the arbitrators to be Europeans. The shipper from England generally insists that one of the arbitrators be a European merchant.

In view of the penalties liable to fall on the shipper, he usually transfers such liabilities as he can to the shoulders of the manufacturer, and therefore the order to the manufacturer is made out indorsed "Indian contract." The shipper's customer in India is usually a native merchant, who sells on commission and who does not hold any stocks himself, as the banks finance the transaction. When the shipper has shipped the goods he lays all the documents and the goods themselves in the hands of one of the Indian bankers, and at the same time draws a sight draft on the Indian merchant for the amount of payment. The bank stores the goods in one of its godowns, and does not part with them to the Indian merchant until the sight draft has been honored. In this way the shipper's loss is restricted to loss of market instead of loss of goods. If the Indian customer defaults, the shipper still has his goods, and disposes of them, although he may suffer a slight loss in the transaction.

It may be added that the method of trading appears to be peculiar to India and to some markets in the Far East. Most of the China and Japan business is done through Chinese or Japanese houses with branches in London, but in this case the method is different. The shipper sends the bill of lading to the London house and gets cash against document. In other markets, such as the Near East, South America, and Africa, the foreign merchant buys the goods outright and does not deal on commission. It must be borne in mind that

one or two big English shippers do not deal in this way. They have their own warehouses in Bombay or Calcutta, where they carry large stocks, and the native buyer can go there and buy his cloth and pay for it just as merchants do in the home trade.

IMPORTANCE OF SHIPPER'S POSITION.

In considering the position of the shipper as a link in the chain between the manufacturer and the ultimate consumer, it must be remembered that it is while the cloth is in the shipper's hands that it goes to the bleacher, the dyer, the printer, and the finisher, so that the shipper is perhaps the most important single person through whose hands the cloth passes. Only one of these auxiliary industries is sufficiently capable of classification to be able to issue a price list. The dyer works and quotes entirely according to shade. There is of course, in the case of blacks, for example, a fairly even price, but dyeing is usually associated with finishing and bleaching. Finishing is almost entirely a matter of specialty, and no one man's work can be said to be the same as any other's. Finishing can be tested only by the feel of the material, and it is almost impossible to attempt any classification. The case of bleaching, however, is different, and price lists are regularly issued for bleaching with some simple standard finish.

In connection with the "Indian contracts" which the shippers write across their orders, the bleachers have drawn up a document of their own, stipulating the conditions under which they are prepared to accept orders for bleaching for the Indian market.

MOVEMENT OF GOODS.

In view of the importance attached to concentration of the cotton industry in east and southeast Lancashire, it may be worth while to follow the movement of the material from dock to dock; that is, from raw cotton on the ship to the finished product packed for export. This perhaps will give the American manufacturer a clearer idea of the actual day-to-day operations than any description of a particular part of the market.

Up to the spinning mill the procedure is very like that in the United States. The cotton is landed at Liverpool or Manchester and proceeds by rail to the mill. Liverpool has to cart the cotton from the docks to the railway; Manchester unloads it directly from the ship into the railway cars, and if sidetracks are available it is transferred from the cars to the first preparation rooms. Few mills, however, have sidings, and the cotton is usually carted from the railway station to the mill, which is usually half a mile away. In some cases the spinning mills have their cotton brought by motor vans, in which case a considerable saving is effected. After the process of spinning the yarn travels by rail or motor vans to the weaving sheds.

EFFECT OF SEPARATE SPINNING AND WEAVING ESTABLISHMENTS.

In Lancashire spinners rarely have looms, and conversely manufacturers rarely have spindles. This is an interesting difference between the American and the English practice, and would appear on the surface to be less satisfactory and less economical than the American

plan of spinning and weaving in one establishment. The English method entails extra transport, but experience has shown that the system of separating spinning and weaving, as worked in Lancashire, is sound economy. The yarn market and the cotton market are very different, and still greater are the differences between the kind of manager required for a spinning mill and one required for a weaving shed. Weaving is a much more highly specialized business. The market for yarn is much steadier and there is much less opening for individual opinion in judging quality and value of yarn than quality of cloth. The success of the manufacturer depends, to a great extent, on his having a private market. He must know exactly what orders he can take and must arrange deliveries so that he has goods ready for the loom as soon as the work in hand is finished. This means a very minute knowledge of the rate at which work can be done. In spinning, on the other hand, there is a tendency for the management to be separated into two divisions. A group of directors may determine the business policy of a number of mills in which they are interested, leaving for the manager only the task of inside management. In manufacturing there can be no such division between inside management and commercial policy; the one depends on the other.

For these reasons the separation of spinning and weaving has a sound practical basis of business economy, which more than makes up for any apparent extravagance in the matter of transport. After the goods have left the manufacturer's works the next stopping place is the shipper's warehouse. But this is rather more than a step in the progression. The shipper's man has to inspect the goods for faults in the weaving, stains, or other defects that may appear in the bleach.

METHOD OF TRANSPORTATION.

So far the transport of the goods has been almost entirely by rail, except in cases where the spinning mill adjoins the weaving shed. These cases are, however, very rare, as spinning is confined mainly to Oldham, Bolton, and the districts near Manchester, and the weaving is done in Preston, Blackburn, and Colne, towns in the north and northeast of Lancashire (40 or 50 miles from Manchester). When the goods leave the shipper to be finished, whether to be bleached, dyed, or printed, the method of transport undergoes a change. Most of the bleachers and dyers have their own motor vans, that call at the shippers for the goods and return them to the shipper's warehouse.

It has been a long struggle between motor vans and the railway company for the carriage of these goods, but it may safely be said that the motor van has won, largely on account of the greater convenience. Motor vans have much greater radius of action, and if the bleacher's works are not far away they make several journeys in one day, carrying very large loads, whereas the railway company, for most traffic between Lancashire towns, collects one day and delivers the next. The cost is always included in the bleacher's quotation.

PACKING AND SHIPPING.

When the goods are returned to the shipper's warehouse, the cloth may have still another journey to make, namely, to the packing establishment. This is unusual, however, as most of the big shippers have

packing plants of their own, and most of the small shippers take offices in a warehouse owned by a packing company. There are several of these warehouses in Manchester consisting entirely of suites of offices, in the basement of which there is a battery of hydraulic presses. The arrangement in the case of these packing warehouses is that the tenant pays a nominal rent for his office and undertakes to get all his packing done by the landlord. For example, a suite of rooms that would ordinarily cost \$750 a year is let for \$150 to \$200 to a shipper who agrees to have his packing done on the premises.

In view of the extreme secrecy with which shippers guard their private marks, this arrangement for packing is rather singular, and it is a well-known fact that leakage takes place in spite of the most jealous care by the shippers in the building. Nevertheless, the arrangement is so convenient that the shippers are glad to put up with whatever objectionable feature it may have.

The next and last step is the transmission for shipment, but as steamship companies are largely international concerns, or rather concerns that carry on an international business, there is little to be said that is not already known to American manufacturers engaged in export trade. The shipper having packed, stamped, and labeled his goods, delivers them not to the steamship company but to a middleman, who is called a shipping agent, and who acts for the steamship company. These shipping agents take charge of the goods from the shipper's warehouse, make the necessary measurements, weights, etc., and take all documents to the steamship company. The latter in return hands over the bill of lading, which is transferred to the shipper and exchanged by him for cash.

BLEACHING.

As already pointed out, bleaching is a separate branch of the English cotton industry, and is carried on in separate works, to the order of the shipper. I have not been able to discover that there is any great difference between the methods employed in England and in the United States. The same processes generally are common in both countries, as one would expect, since they are largely the invention of the engineer who supplies the bleaching machinery, and English machinery is used to a large extent in American bleach works. In Lancashire the kier most widely used is the Mather, which is also extensively employed by American manufacturers. Other high-pressure kiers are in use in England, but the Mather is by far the most common. There are still many works in England equipped with open kiers, which are used to a limited extent in the United States, but new plants rarely contain them. The open, or low-pressure, kiers are employed in Lancashire mostly for very light goods where there is not much difficulty in getting rid of the sizing material used in working the yarn.

The objection to the open kier is that although it is cheaper it tends to stain the goods, especially if any part of the cloth in the kier rises above the liquid. If that happens, the cloth is liable to be tendered, owing to the formation of the oxycellulose, and great care must be exercised to prevent it. For heavy goods high-pressure kiers must be used in order that all the sizing materials be cleared, especially if the cloth is intended for dyeing purposes.

Another thing that has made high-pressure kiers all but universal in Lancashire is the fact that most of the bleachers are now members of the bleachers' trust, and the organization tends more and more to the exclusive use of high-pressure kiers. However, the electrolytic bleaching plant is finding favor, and it is a better apparatus than anything that is available for American manufacturers. It is coming particularly into favor with those dyers who do their own bleaching. Unless the goods are of a very light shade, only a half bleach is necessary, and for that purpose the electrolytic method has a great advantage, particularly in the matter of price. It may be noted that although bleaching, dyeing, finishing, and printing are separate industries, carried on at separate works, there is still much overlapping. For example, some works are equipped for doing bleaching, dyeing, and finishing; that is, a shipper wanting his cloth white can send it to the same man as if he wants it dyed. In the same way a printer does his own bleaching and his own finishing, but in the main it is true that each process is a separate industry. Normally, a dyer bleaches only for his own use and a bleacher bleaches only for the market.

BLEACHERS' MARKS.

One of the most interesting features noted is the control that bleachers, independent of the shipper, have over their own trade. It is usual for bleachers to have a trade-mark for every piece of cloth that they bleach. This is an old custom, and as a result the buyer in India or China, or wherever it may be, is familiar with a mark, and associates it with a certain finish. This custom has given the bleacher great control over the shipper, for the latter finds that his inquiries coming from abroad are for cloth of a certain quality and a certain finish, naming the mark. This mark, of course, is the property of the bleacher, and the shipper is required to send his cloth to that particular bleacher in order to satisfy his customer's requirements. One needs only to compare the position of the bleacher in this matter with the manufacturer's position to realize the strength of the former. The brand of cloth that the shipper's customer asks for is not distinctly specified. The shipper is free to buy it from any manufacturer that can make the required quality, but he is not free to get any finish that may be equal to the one specified. He is asked for a particular finish and must go to the bleacher that can give him the mark.

In the beginning, of course, such a mark is applied by the bleacher to a particular finish. If it becomes popular and in great demand abroad, other bleachers can easily obtain the same finish, and possibly do it at a lower price, but they dare not put the same mark on it, and the customer abroad, unless he sees that mark, does not believe that it is the same finish, and may reject the goods. The shipper may then try to get a manufacturer to make a cloth of slightly lower quality and send it to the bleacher to finish and put his mark on. It is to the bleacher's interest, of course, to refuse to do this, because it will eventually injure his trade, for the native buyers will lose confidence in the mark if the cloth is inferior. It is easy to see that the shipper will have great difficulty in getting the native buyer to take the cloth with a different mark.

The good will of such marks is very great, and when the bleachers' trust was formed as much as a million dollars was paid for the good will of certain marks. The "Golden Beetle" is an instance in point, the firm that owned that particular mark being paid a very high price for transferring the good will to the bleachers' trust.

Competition among the shippers themselves constantly tends, of course, to substitute other processes of finishing in order to obtain a footing in the market. An example of this is the schreiner finish, which is well known and has been in use for many years both in England and in the United States. It had its origin in an attempt to get a footing in a market already occupied by some standard finish.

The shippers, of course, use marks that compete with those of the bleacher for the favor of the native buyer. The dyers, since the formation of the dyers' trust, have adopted the system of stamping all pieces dyed at the works, so that in some cases a piece of cloth may carry two stamps. If it is white, there is the bleacher's stamp and the shipper's stamp on each yard. If it is dyed, there may be the stamp of the dyers' trust and that of the shipper on every yard of the cloth.

BEETLE FINISHING.

The use of the beetle finish is very much more common in England than in the United States, and almost every works can turn out a beetle-finished cloth, if desired. It is being increasingly used as a pure finish—that is, without any admixture of size—and more particularly with printed goods. It is perhaps the most expensive finish of all, but as the demand in England is largely for goods of high quality the cost of finish is less in proportion than it would be on goods of a lower quality.

The effect of the beetle is, of course, to fill up the cloth in much the same way as size fills it, only instead of accomplishing this by adding starch and china clay, it is done by flattening the fibers of the cloth to give it a full appearance and at the same time impart a high polish by the constant friction of the pounding of the beetles.

Beetle finishing is largely carried on in the north of Ireland, where labor is comparatively cheap and a good deal of water power is available. The Irish finishing works may have half a dozen small sheds for beetling placed at intervals along the course of a stream and rely entirely on the stream to give them the necessary power. It is a curious fact that turbines of American make are almost invariably used in these places for driving. Ireland is the home of the beetle finish, because it is the standard finish for linen, and the manufacture of linen is almost entirely confined to the north of Ireland.

DYESTUFFS AND DYEING PROCESSES.

There is little difference in the practice of England and the United States in the processes of dyeing. American manufacturers are more particular on the score of fastness, but English dyers are better at fancy shades. In the United States a big output is the desideratum; in England they care more about variety of effects and delicacy of shades. When a new dyestuff appears the American manufacturer wants to know whether he can get his colors fast to washing and sunlight. The English dyer asks that, too, but also what variety

of effects can be obtained with cross dyeing or discharge and resist work.

England appears to be a little ahead of the United States both in the art of dyeing and in the buying of drugs. There is no trace in England of old-fashioned methods, although dyeing as a craft is much older than in the United States. As is well known, new methods of dyeing with direct cotton dyestuffs have come almost entirely from Germany, and owing to the ease of communication between England and Germany English dyers appear to take up new processes rather quickly. There has grown up of late in England a regular system whereby the sons of the principals of English dyeing houses visit German color works and spend half a year there in order to familiarize themselves with the business, and agents of German firms steadily cultivate friendly relations with the heads of English dye works.

DYEING PROCESSES.

There are fewer differences between American and English practices in dyeing than in manufacturing, but there is a tendency in England to use more freely the complicated forms of dyeing processes, such as the diazotizing process and the developed process. This is due to the fact that the dye house and manufacturing plant are separate establishments and each dyer handles a great variety of shades and a comparatively small number of pieces. It is uncommon for an English dyer to have a run of several thousand pieces; more often he has 200 or 300 pieces to dye to one shade and 200 or 300 of another. This tendency is less marked than it was before the formation of the great combines, the object of which has been to effect economies in matters of this kind. In consequence of this demand for variety the English dyer is always on the lookout for new styles with which he can tempt the manufacturer and get a reputation for skill and ingenuity, and this disposition leads him to investigate anything new.

England takes more interest than the United States in processes devised by German color makers. Vat colors have been more largely used in the United States than in England, the reason for which is plain. American manufacturers are producing cloth mostly for the home market and fastness is of great importance. Vat colors are the fastest to light and washing of all colors made by aniline dye manufacturers. They are mostly derivatives of synthetic indigo and are handled in much the same way as indigo. I find that they are being used in England largely by calico printers for striped shirtings. Formerly calico printers in Lancashire were unable to sell striped effects for shirtings on account of the looseness of printed colors, which would not stand the severe treatment of a laundry. The methods of the modern laundry resemble those of a bleaching concern, and colors must be fast to stand borate of soda. Calico printers have been able to use vat colors to produce striped shirtings for the home trade and for other markets equal in fastness to indigo and alizarin. Perhaps what has kept back the use of vat colors in England has been the fact that very fast colors are not usually required for export trade. India and Argentina demand fast colors, but Africa, which is a big market, takes principally loose colors.

COST OF DYESTUFFS.

As a rule, the prices of dyestuffs in England are lower than in the United States, even when the tariff is taken into consideration. The dyers in England, who conduct their plants as a separate business, pay much attention to the buying of drugs and are keen to get a cent per pound reduction in price. They are also very large buyers. American manufacturers, on the other hand, are not so careful about the price, as dyeing is only one of a number of processes that enter into the final cost of the goods. In England wherever manufacturers do their own dyeing it is generally found that they pay a little more for their dyestuffs than an outside dyer. They are content to leave their dye house alone if it is being run to their satisfaction—a cent a pound cuts no figure on the ultimate cost of goods. In addition, there is the greater cost of freight and packing from Germany to the United States.

There is, however, another factor at work in England. Even the smaller German and Swiss dye manufacturers have representatives in Lancashire and Yorkshire, who are paid from the head office and are not in any sense agents for the firm. In the United States it is unusual for any but the largest firms to have representatives. Most of the business is carried on by independent firms who have the agency for certain dye firms, and who work either on commission or as merchants, taking their profit in the ordinary way. They are, in fact, middlemen, so that dyestuffs have to bear an extra profit in the American markets compared with the English. Moreover American dyestuff merchants have to face very heavy expenses for traveling. The English representative of a German house pays no more than \$5 or \$6 a week in traveling expenses to enable him to meet all his customers, whereas in the United States a very much larger sum would have to be spent to see the same number of people. The custom of the dyers coming on the exchange twice a week saves considerable traveling on the part of the dyeware companies' men, as most of the latter attend the exchange and many orders are taken by word of mouth across the floor.

It must also be borne in mind that the combination of firms that use dyestuffs into trusts has materially lowered prices in England. Before the combines were formed I think there was not much difference in price, but the formation of the combines meant an upheaval in this trade, as in many others, and when conditions had become normal again the prices of all dyewares and drugs had fallen materially. So long as American manufacturers are unable to apply the same pressure on the dyeware merchants as has been applied by the English combines, I believe there is not much chance of their buying dyewares as cheaply as the English dyers.

The diazo colors have suffered considerably from the competition of vat dyes, and there is much less demand for them than formerly. They are still largely used here for blues, but being much less fast than the vat blue they are losing their hold. Sulphur colors are perhaps less used than they were a few years ago. They still hold their own for blacks, and the recent advance in price in direct cotton black has helped a little. In spite of this increase, however, which was due to the convention of the leading dye-manufacturing firms, direct cotton blacks are very widely used in England.

Rarainbranine red still maintains its hold as the chief competitor of alizarin, particularly in calico printing. Aniline black is used very widely, but the same defect that tends to limit its use in the United States operates in England. It is highly incalculable and the dyer can never be sure that he is not going to suffer from tendered cloth.

COMBINES IN THE TEXTILE TRADE.

No account of British marketing would be complete without a short description of the trusts, or combines as they are called in England, which have arisen during recent years in the textile trade. Like most trade associations, they were formed as a result of excessive competition among members of certain industries.

The movement for amalgamation started with the fine-cotton spinners, and this was accomplished by one man, who approached all the cotton spinners producing fine counts and gradually induced them to join. The success of this concern led to the formation of others, and it was soon followed by the Bradford Dyers' Association, consisting of firms which dyed cloth for shippers and which possessed certain trade-marks well known in foreign markets. Following the formation of the latter association the Calico Printers' Association was organized; then came the British Cotton and Wool Dyers' Association, for the dyeing of raw cotton and wool, and the Bleachers' Association.

All these combinations had their origin in the keenness of competition that arises when there is intimate contact between buyer and seller, as in Lancashire. With the exception of firms that had trade-marks there was no protection for any dyer or printer against competition so severe as to ruin his trade, and when the promoters of the combine approached such firms, after their many years of low prices and indifferent trade, there was little or no opposition to the scheme. In most cases the firms themselves were allowed to suggest a price for their business, and it is alleged that some very high prices were paid. It was also pointed out to them that if they remained outside the combine they would be subjected to severe competition.

ECONOMIES PLANNED BY ELIMINATING COMPETITION.

The promoters seemed so sure that great economies could be effected by eliminating competition that they were prepared to accept almost any figure to add a firm to their list. In the matter of economy it was clear they had a very good case, for there was enormous duplication. For example, there were 80 or 90 separate firms of calico printers, each maintaining a warehouse and office in Manchester in addition to its works in the country. Each of these concerns had to maintain a large staff to call upon shippers in Manchester and another staff to remain in the salesroom to show goods. Not only that, but they were handicapped by the smallness and the excessive variety of the orders they received. In calico printing a long run of many pieces has an even greater advantage than in bleaching and dyeing. Great preparations are necessary for each pattern, and, as American manufacturers know, the cost of printing 1,000 pieces is not much more than the cost of printing 500. The expense of new designs was very great, as for each new design a roller had to be engraved. Further, drugs were bought in small quantities and on less favorable terms. The

cost of supervision of labor was very high, and because of the extensive warehouses in Manchester establishment charges were entirely out of proportion to the amount of business.

All this applied, though perhaps in a less degree, to the other combines. It was part of the system of the Lancashire manufacturers to leave the finishing of the cloth entirely in the hands of the customer, and the latter naturally liked to have as large a number as possible competing for his orders.

Practically all this is now changed. A shipper who wants his cloth bleached can send it only to the Bleachers' Association; if he wants it dyed, he must send it to the Dyers' Association; if he wants it printed, he must send it to the Calico Printers' Association. There are, however, a few firms outside the combines, and, owing to the policy of the combines themselves, the shipper has, to some extent, the benefit of competition.

DIFFICULTIES ENCOUNTERED.

Many of the economies that the combine set out to effect no doubt have been realized. It has been a much more difficult task and has taken much longer than anticipated by the promoters, but most of the combines are now in fairly smooth water. In each case the first five or six years were the most difficult. It was part of the consideration of purchase in most combines that the principals of each firm and most of the heads of departments should be given a 5-year engagement at salaries not less than those they had been receiving. This arrangement was necessary to amalgamate, but it occasioned great trouble afterwards. The principals of the concerns, who heretofore had been independent and responsible to no one for the conduct of their business, were turned into salaried employees responsible to a general board of directors, and endless trouble was caused. Not only that, but for a long time it seemed impossible to get a general executive of sufficient experience and knowledge of affairs to handle a concern one hundred times as big as any to which he had been accustomed.

In an endeavor to effect all the economies possible during the first few years wholesale dismissals of staff took place. Warehouses and works were shut up on every hand, but the output remained practically the same, for the first glance at the affairs of the combine showed that about half the printing machines bought were sufficient to do all the calico printing needed in Lancashire. It was found, when the work of each firm was examined, that 20 or 30 were engaged on a few hundred pieces of the same pattern and the same shade for the same market. This meant that 70 color mixings were required and 20 machines prepared where one color mixing and one machine could do the work. The combine found, however, that centralization could be pushed too far. It tended to narrow the range of patterns and reduce the buyer's choice, and shippers complained that they were losing their hold on the foreign markets.

REACTION FROM POLICY OF CENTRALIZATION.

After this first attempt at centralization a reverse tendency set in, and each firm was allowed to make its own experiments, to follow its own ideas for design, and, generally, to determine its own way of

working, with this difference, that a joint committee sitting in Manchester was kept informed of the work of each branch and recommendations were made on the strength of this information, pointing out where economies could be effected and transferring work where necessary from one branch to another. At the same time some salesrooms that had been closed were reopened, but a central salesroom was established where all the most important designs and colorings from the various branches could be seen. In this way it was hoped (and it has since proved to be the case) that eventually a central salesroom would be established where all the work of the association could be seen by the shippers or by the shippers' friends who occasionally visited Manchester, while at the same time the shipper himself could deal with the particular firm with which he was in the habit of dealing without interference from headquarters. This has proved to be a most satisfactory solution of the difficulty. Every other combine had much the same experience.

EFFECT OF COLLECTIVE BUYING OF SUPPLIES AND EQUIPMENT.

Another direction in which great economies were expected was in the buying of drugs, and here the effort of the combines to effect economies had a very marked influence on the trade in general. In most places dyeing was in the hands of a foreman dyer, who was usually without any scientific training or knowledge of the drug he was using, and who relied for the most part on a recipe book in which he had made notes of a number of processes. Some of these recipes were useful as practical measures, but for the most part they were useless in view of the great volume of information constantly pouring from the German dye-manufacturing firms into the hands of the dyer in both England and the United States. The formation of combines marked the end of the power of the foreman dyer. One by one the works were put in charge of young chemists coming straight from the university, who had a great deal of knowledge of drugs and processes but no practical experience of any kind. It was not long, however, before these young men had learned the run of the works, and the foreman was dispossessed of his job and the young chemist made manager.

The policy of the directors of the combine was, of course, collective buying. They found, after the formation of the combine, that each concern was paying a different price for the same dyestuff, and, naturally, all these prices were revised downward to the level of the lowest that any branch was paying. This led to much trouble with the foreman dyers, who often had secret relations with the dyestuff merchants, but this opposition made the directors all the more keen to have in command of their works men that they themselves had selected.

In the buying of plants very much the same thing happened. A superintendent engineer was appointed, through whom all the buying of plant was done; the mechanic at the mill had no further say in the matter, and great economies were effected. In the matter of plant the great financial strength of the associated companies gave them an advantage. They were able to install everywhere the most

expensive and up-to-date plant and to effect economies that were out of the range of individual firms.

ATTITUDE TOWARD INDEPENDENT FIRMS.

The combine's great financial strength also gave it the ability to take a larger view of conditions. One instance serves to show what big operations can be conducted by these combines. By means of a special finish which it had invented an independent firm outside the combine had succeeded in making inroads into the latter's trade. It was a part of the nature of the combine to be alarmed over any considerable development of smaller competitors, particularly if the small competitor had secured his ideas by registration or patent protection. In this case the association felt bound to approach the independent firm with a view to buying its process, but met with a refusal. The combine then set its whole force of scientific men at work to discover a way of getting the same finish without infringing upon rights belonging to any other firm. These efforts met with considerable success, and the association went to the expense of building a very big place not far from Manchester to carry out these special processes. After the works were completed, at a cost of many hundred thousands of dollars, and before the machinery was put in, the independent competitor weakened and consented to sell his place for the price offered him. The new plant which the combine had erected was therefore not needed, and it has remained unused for many years in a valley near Manchester.

RELATIONS OF COMBINES AND MIDDLEMEN.

After the combine had settled its early differences it began to turn attention to strengthening the position of its goods on the market and found, as American manufacturers had found, that the middleman puts obstacles in the way of the producer getting in touch with the public. The printer and the dyer envied the position of the bleacher and finisher in the latter's possession of a large number of trade-marks that were known all over the world, and wished to emulate the bleacher's success; but the position of the bleacher was not attained in a day; it had been the result of many years' steady building up. The first step was taken by a large firm of manufacturers in Manchester who catered very largely to the home trade, and it was in this market that they first tried branded goods.

Branded goods are, of course, the commonest method of selling in the United States, but in England the middleman generally owned the brand, especially in the home trade. Great Manchester warehouses have names that are familiar as household words all through England, and they have offered the strongest opposition to any attempt on the part of manufacturers to oust them from that position. The manufacturer feels that while he is working goods for the merchant to put a brand on, he will always be at the mercy of the latter, who can take the cloth to any other manufacturer or printer, as the case may be, and have the finish imitated in a lower quality. On the other hand, the middleman feels that if he allows the manufacturer to brand the goods and advertise that fact to the public, other

merchants, knowing where he is buying it, will step in and get his trade. Of course no single manufacturer dares face the hostility of the middleman, but the combine is strongly inclined to risk it. The Bradford Dyers' Association advertises its finishes both to the public and to the shopkeepers, and publishes its mark "B. D. A." in many journals. Recently there has been some attempt on the part of the Calico Printers' Association to follow the example. There have appeared in the press a number of advertisements with cuttings of prints attached, bearing the mark "C. P. A." It is still to be seen, however, whether the merchant will be strong enough to resist this tendency on the part of the combine to follow a strong commercial policy. The combines are big wealthy corporations, but their balance sheets are not so satisfactory that they can afford to run any serious risk of loss of trade. On the other hand, the merchants are not combined. They are separate, individual organizations, with no common policy, and for the most part are competing very keenly against one another for the favor of the shopkeeper and the public.

COST OF FINISHING.

[From report of Tariff Board of the United States on Cotton Manufactures.]

The English rates for finishing are fixed by bleaching and printing associations that control about 80 per cent of the business in their respective fields, and these rates are closely followed by the few independent concerns. The charges in the United States are fixed independently by different plants and in the table following, which gives a comparison of charges per linear yard for finishing in the United States and England, the rates for the former country are those predominant during the period of investigation.

Sam- ple No.	Kind of finish.	United States.	Eng- land.	Sam- ple No.	Kind of finish.	United States.	Eng- land.
1-8	Not finished.....			45	Bleached and printed.....	\$0.0125	\$0.0132
9	Bleached.....	\$0.0038	\$0.0066	46	do.....	.0138	.0177
10	Filled, glazed, and bleached.	(¹)	.0253	47	do.....	.0125	.0152
11	Bleached.....	.0065	.0097	48	Mercerized, bleached, and printed.....	.0150	.0152
12	do.....	.0060	.0065	49	do.....	.0163	.0890
13	do.....	.0050	.0101	50	Bleached and printed.....	.0175	.0208
14	do.....	.0125	.0164	51	Registered print.....	.0238	.0228
15	do.....	.0050	.0065	52	Creped, bleached, and printed.....	.0800	.0280
16	do.....	.0050	.0065	53	Printed.....	.0150	.0216
17	do.....	.1163	.0060	54	do.....	.0175	.0177
18	do.....	.0063	.0073	55	Bleached and printed.....	.0150	.0208
19	do.....	.0075	.0073	56	Bleached.....	.0125	.0152
20	do.....	.0068	.0065	57	Mercerized, bleached, and printed.....	.0125	.0152
21	do.....	.0063	.0062	58	Bleached and printed.....	.0138	.0152
22	do.....	.0060	.0068	59	Bleached.....	.0125	.0152
23	do.....	.0063	.0068	60	do.....	.0125	.0177
24	do.....	.0075	.0062	61	Filled and dyed.....	(¹)	.0253
25	do.....	.0060	.0062	62	Filled and glazed.....	(¹)	.0630
26	do.....	.0075	.0062	63	Not finished (yarn dyed)		
27	do.....	.0075	.0068	64	Mercerized and dyed.....	.0150	.0208
28	do.....	.0075	.0068	65	Mercerized.....	.0175	.0203
29	do.....	.0063	.0068	66	do.....	.0150	.0208
30	do.....	.0075	.0063	67	do.....	.0150	.0208
31	do.....	.0075	.0062	68	Not finished (yarn dyed)		
32	do.....	.0063	.0068	69	Dyed and schreinered.....	.0125	.0126
33	Mercerized and bleached.....	.0125	.0139	70	Mercerized and dyed.....	.0175	.0152
34	Bleached.....	.0075	.0062	71-99	Not finished (yarn dyed)		
35	Mercerized and bleached.....	.0125	.0139	90	Pile cut and dyed.....	(¹)	.0944
36	do.....	.0125	.0139	91	do.....	(¹)	.0658
37	Bleached.....	.0075	.0065	92	Cut and dyed.....	(¹)	(¹)
38	Bleached and schreinered.....	.0150	.0140	93-97	Not finished (yarn dyed)		
39	Printed.....	.0175	.0203	98	Dyed.....	.0150	.0253
40	Bleached and printed.....	.0125	.0152	99	do.....	.0150	.0253
41	Printed and hot-calendered.....	.0125	.0202	100	do.....	.0175	.0253
42	Bleached and printed.....	.0138	.0202				
43	Printed.....	.0125	.0202				
44	do.....	.0113	.0152				

¹ Not obtained.

The uniform prices charged by English mills (August, 1911) for finishing cotton cloths follow. These are the standard published charges, for which there are no similar standard rates in the United States.

DYEING PRICES IN LANCASHIRE—GENERAL CONDITIONS.

Accounts less 2½ per cent discount to be settled during the month following the date of invoicing.

Five per cent interest charged on overdue accounts.

All goods subject to a lien for any general balance due to the Association.

Goods invoiced to be charged at cost price only.

No allowance made for any length beyond that actually received grey.

No goods taken to account if not returned in 28 days, and no deductions allowed unless previously agreed to.

No claim on goods shipped can be entertained unless our representative is given an opportunity of examining the goods.

Re-dyes charged full list price and done at the risk of the owner.

In case of goods spoilt for which an invoice is accepted our responsibility extends only to the pieces actually spoilt, and no responsibility is taken for any loss through broken assortments or other contingent loss.

No responsibility is taken for damages caused by pins, hooks, etc., or other manufacturer's faults.

While taking the greatest care with patterns, invoices can not be accepted for them if not satisfactory.

Grey widths, lengths, and weights to be stated on order sheets.

Widths, lengths, and weights stated are for grey. Prices quoted are for finished lengths.

No verbal contracts or quotations recognized.

All current rates and quotations are subject to revision at any time without notice with the exception of goods in work or of specific written contracts.

For less quantity than 300 yards per shade, 300 yards will be charged for, such cloth to be of the same width, weight, and quality throughout.

No percentage of aniline, developed, or sulphur blacks included in assorted orders at an all-round rate.

Dress satins, satin brocades, satin stripes, plain and fancy beatrice twills, plain and figured lastings, fancy figures.

[Satin and beatrice twill grounds.]

Grey width.	Grey length.	Grey weight.	White, cream, common black and all colors, excluding aniline, developed and sulphur blacks.			
			Ordinary finish.	Schreiner finish.	Mercerized finish.	Mercerized and schreiner finish.
	Yards.	Pounds.	Cents.	Cents.	Cents.	Cents.
Up to 29 inches.....	90	19	.76	1.26	1.39	1.64
Over 29 and up to 31 inches.....	90	21	.88	1.26	1.52	1.77
Over 31 and up to 33 inches.....	90	22	1.01	1.26	1.90	2.15
Over 33 and up to 36 inches.....	90	24	1.14	1.52	2.02	2.40
Over 36 and up to 41 inches.....	90	26	1.26	1.77	2.28	2.66
Over 41 and up to 45 inches.....	90	28	1.64	2.28	2.66	3.29

For less quantity than 270 yards per shade, 270 yards will be charged for, such cloth to be of the same width, weight, and quality throughout. Thirteen one-hundredths of a cent extra for every 2 pounds (or part of 2 pounds) over above weights.

Splitting included in above prices.

Developed and sulphur blacks, 0.25 cent per yard extra. Aniline blacks, 0.38 cent per yard extra.

Finishes for China.—Colors and common blacks, 0.13 cent per yard extra.

Developed and sulphur blacks, 0.25 cent per yard extra.

Aniline blacks, 0.38 cent per yard extra.

MAKING UP.

(1) *Dressfold or bookfold, including ribbons.*—(a) Without boards, 4.06 cents per end; with boards, 2.03 cents per end extra. (b) Bookfold, 6.08 cents per end, including ribbons.

(2) *In tillets.*—(a) On boards up to $\frac{3}{4}$ -inch, 12.17 cents per end. (b) On boards over $\frac{3}{4}$ -inch to 1 inch, 14.19 cents per end.

(3) *Rolled on 1-inch pegs.*—(a) Made up in white paper, banded with gilt braid, in plain white boxes, 1 piece per box, 12.17 cents per end. (b) Made up in white paper, banded with gilt braid, in plain white boxes, 2 pieces per box, 10.14 cents per end. (c) Made up as above and parceled 2 ends in parcel, 7.10 cents per end.

Imitation linens, wigans, and domestics.

[For costumes, casements, and apron cloths, plain and figured reps, royal ribs and cords, matings, matting brocades, hopsacks, tussorees, and vestings.]

Grey width.	Grey length.	Grey weight.	White, cream, and all colors, excluding aniline, developed and sulphur blacks.	
		Not exceeding—	Ordinary finish.	Mercerized finish.
	Yards.	Pounds.	Cents.	Cents.
Up to 34 inches.....	90	24	1.27	2.03
Over 34 to 38 inches.....	90	27	1.52	2.41
Over 38 to 45 inches.....	90	30	1.77	2.79
Over 45 to 56 inches.....	90	36	2.28	3.68

Twenty-five one-hundredths of a cent extra for every 3 pounds (or part of 3 pounds) over above weights.

Splitting, 0.13 cent per yard extra.

Developed and sulphur blacks, 0.13 cent per yard extra.

Aniline blacks, 0.25 cent per yard extra.

Made up in warehouse way.—Goods made up lapped or bookfold, 6.08 cents per end, with or without papers, including boards, and parceling.

Hair line or spun glass finishes.

[White, colors, and black.]

	30 line.	Over 30 line.
	Cents.	Cents.
Up to 28 inches.....	1.27	1.39
Over 28 to 32 inches.....	1.39	1.52
Over 32 to 37 inches.....	1.52	1.65
Over 37 to 41 inches.....	1.65	1.77
Over 41 to 46 inches.....	1.90	2.15
Over 46 to 52 inches.....	2.41	2.79

Splitting, one-sixteenth extra.

If made up in lengths of less than 40 yards finished length, an extra charge of 2.03 cents per end will be made.

Twills, twill stripes, jeans, jeanettes, serges.

[Filled, beetled, or calendered, and made up.]

Shades.	Up to 32 inches.	32½ to 36 inches.	36½ to 41 inches.
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
White.....	0.76	0.89	1.01
Slate, dove, cream, drab, straw, fawn, and buffs.....	.89	1.01	1.14
Brown, extra dark slate, and blacks.....	1.01	1.14	1.27
Fancy colors.....	1.14	1.27	1.39

Furniture linings and glazed finish, 0.25 cent per yard extra on above prices.

If made up in lengths of less than 50 yards finished length, an extra charge of 2.03 cents per end will be made.

All goods unusually heavy subject to extra charge.

Pocketings, herringbone pocketings, and stouts.

	<i>Cents per yd.</i>
Slates, drabs, and doves:	
24 pounds and under for 80 yards.....	1.01
Over 24½ pounds and up to 28 for 80 yards.....	1.14
Over 28½ pounds and up to 34 for 80 yards.....	1.27
Over 34½ pounds and up to 40 for 80 yards.....	1.39
Over 40½ pounds and up to 48 for 80 yards.....	1.65
Over 48½ pounds and up to 54 for 80 yards.....	1.90
Over 54½ pounds and up to 64 for 80 yards.....	2.41

Whites 0.13 cent less, browns 0.25 cent extra, and blacks 0.51 cent extra.

Imperials and satins or satin tops pocketing drills, 0.25 cent extra on above list.

Raised backs, 0.38 cent extra on above list.

If raised ready, 0.13 cent per yard allowance.

All colors unusually heavy and expensive will be subject to extra charge.

If made up in lengths of less than 50 yards finished length, an extra charge of 2.03 cents per end will be made.

Satin Drills, Florentines, Herringbones, Reps, and Chain Stripes.

[Shoe lining finish.]

	Colors.	Blacks.
	<i>Cents.</i>	<i>Cents.</i>
Up to and not exceeding 30 pounds, 125 yards.....	1.14	1.27
From 30½ pounds to 35 pounds, 125 yards.....	1.27	1.52
From 35½ pounds to 40 pounds, 125 yards.....	1.52	1.65
From 40½ pounds to 45 pounds, 125 yards.....	1.65	1.90
From 45½ pounds to 50 pounds, 125 yards.....	1.90	2.16
From 50½ pounds to 55 pounds, 125 yards.....	2.28	2.54
From 55½ pounds to 60 pounds, 125 yards.....	2.54	3.04

Exceeding 60 pounds per piece, proportionately.

The above goods warehouse way. Fourfold 12.18 cents extra.

Fast Khakis.

(Gray weight.)

	<i>Cents.</i>
For cloths not exceeding 27 pounds, 120 yards.....per yard..	1.27
For cloths not exceeding 27½ to 34 pounds, 120 yards.....do....	1.52
For cloths not exceeding 34½ to 40 pounds, 120 yards.....per pound..	5.07

Bagdad Twills.

Grey width.	Grey length.	Grey weight.	Benzo red.	O. cols. and C. black.	Sulphur blacks.	Aniline blacks.	
Up to 30 inches..	125 yards.	Up to 22 pounds...	<i>Cents.</i> 50 72 76	<i>Cents.</i> 76 91 98	<i>Cents.</i>	<i>Cents.</i>	Tin finish. O. cal. finish. O. cal. finish.

Made up warehouse way.

BAGDAD TWILLS.

Over 30 and up to 39 inches....	104 yards.	22 pounds.....		1.14	1.27	1.39	Bright finish.
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Including make up 40 yards end. Blue glazed paper. No boards.

SPLIT DOBBIES AND JEANS.

Up to 50 inches..	125 yards.	35 pounds.....	.....	1.52	.....	.....	Bright finish.
50 inches.....	90 yards..	45 pounds.....	.....	2.03	.....	.....	

Splitting, 0.13 cent per yard extra. Made up warehouse way.

WIGANS.

Up to 48 inches..	80 yards..	Up to 32 pounds...		1.52			Tin finish.
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Splitting, 0.07 cent per yard extra.

Raising on one side only, 0.25 cent per yard extra.

Make up warehouse way.

DRILLS AND JEANS.

Grey width.	Grey length.	Grey weight.	Benzo red.	O. cols. and C. black.	Sulphur blacks.	Aniline blacks.	
Up to 29 inches...	40 yards..	14 pounds.....	<i>Cents.</i>	<i>Cents.</i> 1.01	<i>Cents.</i> 1.27	1.52	Tin finish.

Including make-up, 40 yards length. No paper. Heavier weights, 0.25 cent per yard extra for every 3 pounds or part of 3 pounds.

Cap, tie, and bag lining finishes only.

	Up to 37 inches grey.	Over 37 to 42 inches.
	<i>Cents.</i>	<i>Cents.</i>
White.....	0.91	1.01
Slate, dove, fawn, salmon, light-green, and common colors	1.01	1.14
Browns and extra-dark slates	1.14	1.27
Fancy colors.....	1.27	1.39

White or colored back-filled, 50-piece runs of 64 yards, 0.13 cent extra.

White or colored back-filled, less than 50-piece runs of 64 yards, 0.25 cent extra.

Slash emboss., 0.25 cent per yard extra.

Made up in pieces of 50 yards or over, under 50 yards, 2.03 cents per end.

Goods weighing 12 pounds and under for 41/70 yards (grey weight) 0.13 cent per yard extra on above prices.

Only half D. & K. allowed on back-filled work 10 pounds and under for 41/70 yards (grey weight).

No cloth in the back-filled finish accepted for dyeing if under 7 pounds (grey weight), of 6 pounds when bleached, for 41/70 yards.

Minimum quantity for a colored back, 20 pieces of 70 yards to a color.

For less quantity than 300 yards to a shade, 300 will be charged for, such 300 yards to be of the same width, weight, and quality throughout.

Extra-heavy cloths to be charged extra.

Watered moreens.

[White, black, and all colors.]

	Ordinary.	Mercerized.
	<i>Cents.</i>	<i>Cents.</i>
27.....	1.52	2.28
27/36.....	1.77	2.79
36/42.....	2.03	3.30
42/52.....	3.04	4.57

Including made-up warehouse ways.

Splitting, 0.13 cent per yard extra.

Hot pressed, 1.01 cents per yard extra.

Developed and sulphur blacks, 0.13 cent per yard extra.

Aniline blacks, 0.25 cent per yard extra.

Lapped and banded, 4.06 cents per end.

Lapped and banded and papered, 6.09 cents per end. Six yard-lengths, 2.03 cents per end.

List for printers and shirtings (plain and fancy), muslin checks and stripes, etc.

[White, cream, and all colors and common black, excluding aniline, developed and sulphur blacks.]

Width.	Length.	Weight.	Tin finish.	Calendar finish.
	<i>Yards.</i>	<i>Pounds.</i>	<i>Cents.</i>	<i>Cents.</i>
Up to 22 inches.....	125	20	0.76	0.89
Up to 32/37 inches.....	125	23	.98	1.01
Up to 37/42 inches.....	125	26	1.01	1.14
Up to 42/46 inches.....	125	30	1.14	1.39
Up to 46/52 inches.....	125	34	1.27	1.52
Up to 52/56 inches.....	125	38	1.39	1.65

Heavier weights in proportion. Splitting, 0.07 cent per yard extra.

Developed and sulphur blacks, 0.13 cent per yard extra. Aniline blacks, 0.25 cent per yard extra.

Making up goods 40 yards and over free (not papered). Making up goods under 40 yards, 1.01 cents per end.

ENGLISH PRICES FOR BLEACHING, FINISHING, AND PUTTING UP.**GENERAL CONDITIONS.**

Monthly accounts 2½ per cent, subject also to notices on delivery notes.

Prices charged on grey widths and white lengths in all cases.

Where goods are charged by counts or weights, such counts or weights to be stated on delivery or instruction notes, otherwise bleacher's counting or weighing to be accepted.

Splits to be charged grey widths, and 0.13 cent per yard for splitting, with the exception of mulls, nainsooks, and printers. For particulars see respective lists.

Unless all colors are guaranteed as fast bleaching colors, and all gold of a quality to stand bleaching, the bleacher will not be responsible for any loss arising from damage in respect of these.

Bleachers will not be responsible for damage caused by the use of deleterious sizing materials.

All parcels stamped, ticketed, or both, same as the goods or otherwise, 0.51 cent per parcel, save and except for a mere description of the contents of the parcel and length stamp, or one character.

Goods for India: All contracts subject to conditions of contract for bleaching of December 1, 1909.

Short length pieces, in all white goods: An allowance will be made in respect of the actual shortage (exclusive of pattern-cut pieces), calculated at the rate of the sale price. Such shortage not to include pieces with heading and tail end or tar mark.

Pieces in two parts (all white light goods, except scarfs and dhooties): An allowance will be made of not exceeding 4.06 cents per piece of any length (exclusive of pattern-cut pieces).

Scarfs and dhooties: Where two perfect half pairs are made up together to form one perfect pair, no allowance will be made.

Merchants are requested to declare in the grey all pieces in two or more parts, or seamed across, and short tab pieces.

BEE-TLED SHIRTINGS, DRILLS, SHEETINGS, TWEELS, ETC.

Light goods (weighing less than one-fourth pound to the yard on actual grey length):

40 inches and under, 0.71 cent per yard, white length.

Over 40 to 45 inches, 0.81 cent per yard, white length.

Over 45 to 50 inches, 0.99 cent per yard, white length.

Heavy goods (weighing one-fourth pound to the yard and over on actual grey length):

40 inches and under, in the grey, 3.04 cents per pound, grey weight.

Goods not averaging 28.42 cents for 40 yards by weight will be charged by length.

Over 40 to 45 inches, 3.30 cents per pound, grey weight.

Goods not averaging 32.48 cents for 40 yards by weight will be charged by length.

Over 45 to 50 inches, 3.55 cents per pound, grey weight.

Goods not averaging 39.58 cents for 40 yards by weight will be charged by length.

Fine beetle shirtings:

Over 50 to 55 inches, light goods, 0.99 cent per yard, white length.

Over 55 to 60 inches, light goods, 1.06 cents per yard, white length.

Over 50 to 55 inches, heavy goods, 4.06 cents per pound, grey weight.

Over 55 to 60 inches, heavy goods, 4.31 cents per pound, grey weight.

Sheetings:

Above 50 inches, 3.30 cents per pound, grey weight.

Rough finish, 0.25 cent per yard extra, white length.

If reversed, 0.51 cent per yard extra, white length.

Brown-paper parcels, 4.06 cents per parcel extra.

Splits to be charged grey width, and 0.25 cent per yard for splitting.

Goods cut or run (open of bookfold) 15 yards and under, 0.51 cent per end. Openfold over 15 to 36 yards, 1.01 cents per end. No charge for cutting on 20 yards bookfolds.

Bookfolding:

40-inch and under, without tape or ribbon, 20 yards, 1.01 cents. 40 yards, 2.03 cents.

Above 40-inch, without tape or ribbon, 20 yards, 2.03 cents. 40 yards, 4.06 cents.

Crease fold:

15 yards and under, 4.06 cents.

Over 15 yards, 6.09 cents. Other lengths in proportion.

Ribboning or taping:

40 inches and under, 1.01 cents per piece.

Over 40 inches, 1.52 cents per piece.

Stamped headings:

One color, and over 3 inches in width, 1.01 cents.

Two-colored, all ordinary sizes, 1.01 cents.

Two-colored, over 3 inches in width, 2.03 cents.

Papery:

Ordinary casing paper, per parcel of more than one piece, 4.06 cents.

Ordinary casing paper, per parcel of one piece, longfold, not exceeding 42 yards, 3.04 cents.

Ordinary casing paper, per parcel of one piece, longfold, not exceeding 42 yards, without lining, string, or tape, 2.03 cents.

Ordinary casing paper, per parcel of one piece, bookfold, not exceeding 42 yards, 2.03 cents.

Ordinary casing paper, per parcel of two pieces, 20 yards, bookfold, 3.04 cents.

White or colored paper, per parcel, longfold, two pieces or more, 5.07 cents.

White or colored paper, per parcel, longfold, single, 4.06 cents.

White or colored paper, per parcel, bookfold, single piece, 20 yards and under, 2.54 cents.

White or colored paper, per parcel, bookfold, 4.06 cents.

Parcels stamped similar to goods, 0.51 cent per parcel extra.

Fancy papers extra.

General remark.—In separating light goods from heavy goods the definition "under one-fourth pound to the yard on actual grey length" must be strictly adhered to.

SHIRTINGS, DRILLS, TWILLS, ETC. (NOT BEETLED).

40 inches and under, in the grey, weighing one-fourth pound per yard and under on actual grey length:

Ordinary mangle or dull finishes, all lengths, 0.65 cent per yard, white.

Bright starch finishes and single heavy finishes, 0.71 cent per yard, white.

Specially low goods, 14 x 14, and under, if twice filled, 0.81 cent per yard, white. 4.06 cents for each time extra filled.

French finish, 0.71 cent per yard, white.

Light mangle finish shirtings (finish not exceeding one-fourth pound over grey weight):

19 by 19 and over, and not exceeding for 33 inches 37½ yards, grey, 5½ pounds, 0.60 cent.

19 by 19 and over, and not exceeding for 36 inches 37½ yards grey, 6 pounds, 0.60 cent.

19 by 19 and over, and not exceeding for 39 inches 37½ yards grey, 6½ pounds, 0.60 cent per yard, white.

Wide goods:

41 to 45 inches, grey, 10 pounds and under for 37½ yards actual grey length, 0.76 cent per yard, white.

45 to 50 inches, grey, 11 pounds and under for 37½ yards actual grey length, 0.86 cent per yard, white.

Heavy goods:

40 inches and under, in the grey, weighing over one-fourth pound per yard on actual grey length, pure or once filled, 2.79 cents per pound.

(N. B.—Any goods that do not average for 40 yards by weight will be charged by length.)

Over 40 to 45 inches, over 10 pounds for 37½ yards actual grey length, 3.04 cents per pound.

Over 45 to 50 inches, over 11 pounds for 37½ yards actual grey length, 3.30 cents per pound.

Each time extra filled or heavily starched:

Up to 45 inches, grey, 4.06 cents for 40 yards.

Over 45 to 50 inches, grey, 6.09 cents for 40 yards.

Over 50 inches, grey, 8.12 cents for 40 yards.

Splits to be charged grey widths, and 0.25 cent per yard extra for splitting.

Bookfolding:

40 inches and under, grey, without tape or ribbon, 1 cent for 20 yards; 2.03 cents for 40 yards.

Over 40 inches, grey, without tape or ribbon, 2.03 cents for 20 yards; 4.06 cents for 40 yards.

Ribboning or taping:

40 inches and under, grey, 1.01 cents per piece.

Over 40 inches, grey, 1.52 cents per piece.

Cutting:

15 yards and under, open or bookfold, 0.51 cent per end.

Papering:

Ordinary casing paper, per parcel of more than one piece, 4.06 cents.

Ordinary casing paper, per parcel of one piece, long fold, not over 42 yards, 3.04 cents.

Ordinary casing paper, per parcel of one piece, long fold, not exceeding 42 yards, without lining, string, or tape, 2.03 cents.

Ordinary casing paper, per parcel of one piece, bookfold, not over 42 yards, 2.03 cents.

Ordinary casing paper, per parcel of two pieces, 20 yards, bookfold, 3.04 cents.

White or colored paper, long fold, two pieces or more, 5.07 cents.

White or colored paper, long fold, one-piece parcels, 4.06 cents.

White or colored paper, per parcel, bookfold, 4.06 cents.

White or colored paper, per parcel, bookfold single piece, 20 yards and under, 2.54 cents.

Parcels stamped similar to goods, 2.54 cents per parcel extra.

Fancy papers extra.

Tambouring and stitchmarking in the white:

One line per letter, 0.51 cent.

Two lines per letter, 1.01 cents.

Three lines per letter, 1.52 cents.

Small figures, under one-half inch per figure, 0.25 cent.

Stitchmarking in the grey:

Per letter, 0.25 cent.

Stamped headings:

One color, over 3 inches in width, 1.01 cents.

Two colored, all ordinary sizes, 1.01 cents.

Two colored, over 3 inches in width, 2.03 cents.

LIGHT GOODS.*Dhooties and scarfs—white borders.*

	Pure finish.	Jaconet and elastic finish.
	<i>Cents.</i>	<i>Cents.</i>
Up to 32 inches..... per yard.....	0.51	0.57
Over 32 to 50 inches..... do.....	.51	.63
Over 50 to 54 inches..... do.....	.63	.76
Over 54 to 60 inches..... do.....	.82	.95

Twice starched, 0.13 cent per yard extra.

Tissue, square fold, 0.13 cent per piece.

Tissue, mull fold, 0.25 cent per piece.

All scarfs 4½ yards and under, 0.25 cent per piece extra.

Brickfold, 0.29 cent per piece extra.

Ten-piece parcels included. Five-piece parcels, 1.01 cents extra.

White paper and tissue, 2.03 cents extra on above.

Colored borders.

[In dhooties and scarfs, also in mulls, doria stripes, mull stripes, and mainsooks.]

	Pure finish.	Jaconet and elastic finish.
	<i>Cents.</i>	<i>Cents.</i>
Up to 32 inches..... per yard.....	0.60	0.73
Over 32 to 45 inches..... do.....	.63	.76
Over 45 to 50 inches..... do.....	.76	.92
Over 50 to 60 inches..... do.....	.92	1.05

Borders not exceeding $\frac{1}{2}$ inch wide up to 16 by 16, pure or slightly assisted:

Up to 45 inches, 0.56 cent per yard.

Over 45 to 50 inches, 0.63 cent per yard.

If over 16 by 16 or 50 inches, or weighing 8 pounds and over for 40 yards—List.

Plain line bordered scarfs, pure finish:

One or two line, any color, not over $\frac{1}{2}$ inch wide, up to 50 inches, 0.51 cent per yard.

Heavy goods weighing 8 pounds and over for 40 yards—List—0.13 cent extra per yard.

Twice starched (very stiff finish)—

Tissue—square fold, 0.13 cent per piece.

Tissue—mull fold, 0.25 cent per piece.

All scarfs $4\frac{1}{2}$ yards and under, 0.25 cent per piece extra.

Brickfold, 0.25 cent per piece extra.

Eight or ten piece parcels included.

Under eight piece parcels, 1.01 cents extra.

White paper and tissue, 2.03 cents extra on above.

FANCIES—SOFT, HARD, OR ELASTIC FINISH.

Gauze (Leno checks, Leno stripes, Leno X overs):

Up to 26 inches, 0.45 cent.

Over 26 to 40 inches, 0.56 cent.

Over 40 to 50 inches, 0.63 cent.

Over 50 to 60 inches, 0.70 cent.

	Up to 14 by 14.	Over 14 by 14 to 18 by 18.	Over 18 by 18.
Tape checks, satin checks, hair-cord checks, lace stripes, ladder stripes, colored stripes, and all fancies:	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
Up to 30 inches.....	0.50	0.63	0.82
Over 30 to 45 inches.....	.63	.76	.89
Over 45 to 50 inches.....	.76	.89	1.01
Over 50 to 55 inches.....	.89	1.03	1.20
Over 55 to 60 inches.....	1.03	1.20	1.43

Split fancies up to 55 inches, 0.68 cent per yard; 0.13 cent for splitting, not less than 2,500 yards of one width.

Satin stripes, Yosemite stripes, brocades:

Up to 30 inches, 0.68 cent.

Over 30 to 45 inches, 0.82 cent.

Over 45 to 50 inches, 0.95 cent.

Over 50 to 55 inches, 1.14 cents.

Over 55 to 60 inches, 1.27 cents.

Satin brocades, satin finish:

Up to 34 inches, 0.82 cent.

Over 34 to 41 inches, 1.27 cents.

Over 41 to 45 inches, 1.39 cents.

Over 45 to 50 inches, 1.65 cents.

Over 50 to 60 inches, 2.22 cents.

Heavy filled tape checks, common finish, 36 inches, 12 yards:

Up to 16 by 16, 0.76 cent per yard.

Over 16 by 16, 0.89 cent per yard.

Morocco satin checks:

Up to 31 inches, not exceeding 14 by 14, 0.56 cent per yard.

All extras as per list.

Wider widths and finer qualities to be charged as fancies.

But if in grey deliveries (at one time of not less than 12,000 yards of all one width, the following prices may be taken, namely, up to 14 by 14, not exceeding 31 inches, at 6.09 cents per 12 yards; 5.33 cents for 10 yards.

Over 14 by 14, not exceeding 31 inches, at 6.85 cents per 12 yards, 6.09 cents for 10 yards.

All extras as per list.

Eccru and scoured fancies, price as whites.

Headings or bands:

Stamped or pasted, for labor only, 0.25 cent extra.

Woven tinsel, pasted only, 0.51 cent extra.

Woven tinsel, stitched only, 1.01 cents.

Tissue, under lap, 0.25 cent extra.

Colored or black paper, 3.04 cents.

Colored or black paper, with tissue, 4.06 cents.

Two narrow ribbons, cotton, 0.51 cent; silk, 1.01 cents.

Two over one-fourth inch wide, cotton, 1.01 cents; silk, 1.52 cents.

In all cases where colored paper is supplied by customers, 1.01 cents per piece is charged for putting on.

Lawns.

	Up to 20 by 20.	Over 20 by 20 to 24 by 24.	Over 24 by 24.
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
30 inches and under.....	0.56	0.56	0.82
Over 30 to 36 inches.....	.73	.73	1.05
Over 36 to 45 inches.....	.76	.92	1.17
Over 45 to 50 inches.....	.92	1.05	1.43
Over 50 to 55 inches.....	1.05	1.17	1.46
Over 55 to 60 inches.....	1.17	1.43	1.62

If cut in less than 10-yard length, 0.25 cent per end extra.

Scoured lawns, same price as whites.

Filled Alexandria lawns, 0.25 cent per yard extra.

China and Japan lawns, 12 yards:

All widths 45 inches and under, up to 14 by 14, 7.10 cents; over 14 by 14 to 16 by 16, 7.10 cents; over 16 by 16 to 18 by 18, 7.10 cents; over 18 by 18—lawn list.

Bookfolding, 24 yards, 2.03 cents; other lengths in proportion.

Parceling, 5-piece parcels, 1.01 cents extra; 1-piece parcels, square fold, any color, 2.03 cents.

Haiti lawns, in customer's own paper, 2.03 cents per parcel.

Two narrow ribbons, cotton, 0.51 cent; silk, 1.01 cents.

Two over one-quarter-inch wide, cotton, 1.01 cents; silk, 1.52 cents.

Stamped or pasted headings or bands, for labor only, 0.25 cent extra.

Woven tinsel headings or bands, pasted, for labor only, 0.51 cent extra.

Woven tinsel, headings or bands, stitched, for labor only, 1.01 cents extra.

PRINTERS AND SPLIT PRINTERS.

Woven, without headings, in less than 100-yard pieces.

Lawn finish.

Single widths, not split—	Up to 16 by 16.	Over 16 by 16 to 24 by 24.	Over 24 by 24.
	<i>Cents.</i>	<i>Cents.</i>	<i>Lawn list.</i>
30 inches and under.....	0.56	0.56	Do.
Over 30 to 40 inches.....	.61	.68	Do.

Wider widths as lawns.

Splits, per single width of 40 yards, including splitting—	Up to 16 by 16.	Over 16 by 16 to 24 by 24.	Over 24 by 24.
	<i>Cents.</i>	<i>Cents.</i>	<i>Lawn list.</i>
40 inches and under.....	13.94	15.20	Do.
Over 40 to 44 inches.....	15.20	15.71	Do.
Over 44 to 48 inches.....	16.73	18.76	Do.
Over 48 to 56 inches.....	20.28	22.30	Do.

Wider widths as lawns.

If cut in less than 20-yard lengths, 0.25 cent per end extra.

Stamped or pasted headings or bands, for labor only, 0.25 cent each extra.

Woven tinsel bands, pasted, for labor only, 0.51 cent extra.

Woven tinsel bands, stitched, for labor only, 1.01 cents extra.

Five-piece parcels, common paper, 1.01 cents each.

Parcels, white paper and tissue, 3.04 cents each.

Other extras as lawns.

INDIA MULLS. PURE FINISH. 17 TO 20 YARDS.

Ten to twelve yards in proportion, plus 1.01 cents. Splits charged on each single width after splitting. On low mulls, one-half inch to be allowed for shrinkage.

Tape-bordered mulls to be charged as nainsooks. If cut in scarf lengths, to be charged scarf prices.

	Up to 14 by 13.	Over 14 by 13 to 16 by 16.	Over 16 by 16 to 20 by 20.	Over 20 by 20 to 24 by 24.	Over 24 by 24.
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
Up to 32 inches.....	5.58	5.58	5.83	6.71	7.22
Over 32 to 42 inches.....	5.58	6.08	6.46	7.22	7.85
Over 42 to 45 inches.....	6.71	6.97	7.22	7.85	8.36
Over 45 to 50 inches.....	6.97	7.85	8.11	8.87	9.50
Over 50 to 54 inches.....	8.36	8.87	9.25	10.14	10.65
Over 54 to 60 inches.....	9.63	10.14	10.65	11.15	11.66

Ten by ten and under, 0.51 cent per piece extra.

If made of nainsook yarn or heavy Jaconet yarn, they will be charged as nainsooks or jaconets.

Swiss saccarilla finish, 2.28 cents per piece extra.

Special saccarilla finish, 4.06 cents per piece extra.

Starched:

Up to 14 by 13, 0.51 cent per piece extra.

Over 14 by 13, 1.01 cents per piece extra.

Stamped or pasted headings or bands, for labor only, 0.25 cent extra.

Woven tinsel, pasted, for labor only, 0.51 cent extra.

Woven tinsel, stitched, for labor only, 1.01 cents extra.

Tissue 0.25 cent.

Tambouring:

Per ornament, in gold, 1.77 cents extra.

Per ornament, in colors, 2.03 cents extra.

Small figure, 0.25 cent.

Large figure, 0.51 cent.

Ten-piece parcels included. Five-piece parcels, 1.01 cents extra.

White paper and tissue, 2.034 cents extra on above.

One-piece parcels, 2.54 cents.

INDIA NAINSOOKS, ABSOLUTELY PURE FINISH.

Splits charged on each single width after splitting. 10 to 12 yards, in proportion plus 1.01 cents.

17 TO 18 YARDS.

	Up to 16 by 16.	Over 16 by 16 to 18 by 18.	Over 18 by 18 to 20 by 20.	Over 20 by 20 to 22 by 22.	Over 22 by 22.
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
26 inches and under.....	6.08	6.59	6.84	7.09	7.85
Over 26 to 40 inches.....	6.59	7.09	7.60	7.85	8.36
Over 40 to 45 inches.....	7.09	7.85	8.11	8.36	8.87
Over 45 to 50 inches.....	8.87	9.63	9.88	10.14	10.65
Over 50 to 54 inches.....	10.14	10.65	10.90	11.15	11.66
Over 54 to 60 inches.....	11.15	11.66	11.91	12.17	12.68

OVER 18 TO 20 YARDS.

	Up to 16 by 16.	Over 16 by 16 to 18 by 18.	Over 18 by 18 to 20 by 20.	Over 20 by 20 to 22 by 22.	Over 22 by 22.
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
26 inches and under.....	6.84	7.47	7.85	8.11	8.62
Over 26 to 40 inches.....	7.47	8.11	8.36	8.62	9.28
Over 40 to 45 inches.....	8.11	8.74	9.12	9.38	9.88
Over 45 to 50 inches.....	9.88	10.66	10.90	11.15	11.66
Over 50 to 54 inches.....	11.15	11.53	12.17	12.42	12.93
Over 54 to 60 inches.....	12.42	13.18	13.44	13.69	14.22

OVER 20 TO 22 YARDS.

26 inches and under.....	7.60	8.24	8.49	8.87	9.63
Over 26 to 40 inches.....	8.36	8.87	9.12	9.63	10.14
Over 40 to 45 inches.....	8.87	9.38	9.88	10.27	10.90
Over 45 to 50 inches.....	11.15	11.53	11.91	12.17	12.93
Over 50 to 54 inches.....	12.17	12.93	13.44	13.69	14.32
Over 54 to 60 inches.....	13.69	14.32	14.70	14.95	15.58

Heavy nainsooks, all widths and picks per single piece, 17 to 18 yards:

Up to and including 40 inches, 3 pounds and over, 2.79 cents per pound.

Over 40 to 45 inches, 3½ pounds and over, 3.04 cents per pound.

Over 45 to 50 inches, 3½ pounds and over, 3.04 cents per pound.

Over 50 to 54 inches, 3½ pounds and over, 3.04 cents per pound.

Over 54 to 60 inches, 4 pounds and over, 3.30 cents per pound.

Other lengths in proportion.

Any goods that do not come up to list price by weight will be charged by length.

All nainsooks over 18 by 18, finished nearer than 1 inch of grey width, charged 2.03 cents extra.

Slightly assisted, 45 inches and under, 1.01 cents; over 45 inches, 1.52 cents per piece extra.

Two narrow ribbons, cotton, 0.51 cent, silk; 1.01 cents; over one-fourth inch wide, cotton, 1.01 cents; silk, 1.52 cents. 10-piece parcels included, 5-piece parcels 1.01 cents extra.

White paper and tissue, 2.03 cents extra on above.

Heavy nainsooks.

ALL PICKS, PER SINGLE PIECE, 17/18 YARDS.

	3 lbs. to 3½ lbs.	Over 3½ lbs. to 4 lbs.	Over 4 lbs. to 4½ lbs.	Over 4½ lbs. to 5 lbs.	Over 5 lbs. to 5½ lbs.	Over 5½ lbs. to 6 lbs.	Over 6 lbs. to 6½ lbs.	Over 6½ lbs. to 7 lbs.	Over 7 lbs. to 7½ lbs.	Over 7½ lbs. to 8 lbs.	Over 8 lbs. to 8½ lbs.	Over 8½ lbs. to 9 lbs.
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
Up to and including 40 inches, 3 pounds and over.....	9.38	10.14	10.90	11.41	12.17	12.93	13.69	14.19	14.95	15.71	16.47	16.47
Over 40 to 45 inches, 3½ pounds and over.....	8.87	10.39	11.15	11.91	12.68	13.44	14.19	14.95	15.71	16.47	17.23	17.99
Over 45 to 50 inches, 3½ pounds and over.....			11.41	12.17	12.93	13.69	14.44	15.20	15.96	16.73	17.49	18.25
Over 50 to 54 inches, 3½ pounds and over.....				12.42	13.18	13.94	14.70	15.46	16.22	16.98	17.74	18.50
Over 54 to 60 inches, 4 pounds and over.....					13.69	14.44	15.20	16.22	16.98	17.74	18.50	19.26

Heavy nainsooks—Continued.

ALL PICKS, PER SINGLE PIECE, 20 YARDS.

	3½ lbs. to 3½ lbs.	Over 3½ lbs. 3½ lbs.	Over 4 lbs. to 4½ lbs.	Over 4½ lbs. to 4½ lbs.	Over 4½ lbs. to 4½ lbs.	Over 4½ lbs. to 4½ lbs.	Over 5 lbs. to 5½ lbs.	Over 5½ lbs. to 5½ lbs.	Over 5½ lbs. to 5½ lbs.	Over 5½ lbs. to 5½ lbs.	Over 6 lbs. to 6 lbs.
Up to and including 40 inches, 3 pounds 5 ounces and over.....	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Over 40 to 45 inches, 3 pounds 10 ounces and over.....	10.14	10.90	11.41	12.17	12.63	13.09	14.19	14.95	15.71	16.47	16.47
Over 45 to 50 inches, 3 pounds 14 ounces and over.....	9.38	11.15	11.91	12.68	13.44	14.19	14.95	15.71	16.47	17.23	17.99
Over 50 to 54 inches, 4 pounds 2 ounces and over.....			12.17	12.93	13.69	14.44	15.20	15.96	16.73	17.49	18.25
Over 54 to 60 inches, 4 pounds 7 ounces and over.....				13.18	13.94	14.70	15.46	16.22	16.98	17.74	18.50
					14.70	15.46	16.22	17.23	17.74	18.76	19.62

Jaconets, 17 to 20 yards.

	Up to 18 by 18.	Over 18 by 18 to 28 by 28.	Over 28 by 28.
26 inches and under.....	Cents. 8.87	Cents. 9.38	Cents. 11.66
Over 26 to 40 inches.....	9.38	10.14	12.17
Over 40 to 45 inches.....	10.14	10.65	12.93
Over 45 to 50 inches.....	12.93	13.44	15.46
Over 50 to 54 inches.....	13.94	14.44	16.73
Over 54 to 60 inches.....	14.95	15.46	17.99

If extra filled or twice filled, 2.03 cents extra.

Tambouring same as mulls (small fancy ornaments, 1.27 cents each).

Ten-piece parcels included. Five-piece parcels, 1.01 cents extra.

White paper and tissue, 2.03 cents extra on above.

Jaconets, 10-12 yards.

	Up to 18 by 18.	Over 18 by 18 to 28 by 28.	Over 28 by 28.
26 inches and under.....	Cents. 6.71	Cents. 6.97	Cents. 8.36
Over 26 to 40 inches.....	7.22	7.22	8.62
Over 40 to 45 inches.....	7.47	7.47	8.87
Over 45 to 50 inches.....	9.25	9.25	10.65
Over 50 to 54 inches.....	9.76	10.01	11.15
Over 54 to 60 inches.....	10.65	10.65	11.91

If extra filled or twice filled, 1.52 cents extra.

Five or ten piece parcels, 1.01 cents extra.

Tambouring same as mulls. (Small fancy ornaments, 1.27 cents per figure.)

White paper and tissue, 2.03 cents extra on above.

CAMBRICS—40-45 INCHES.

(Class 1.)

Pure uncalendered (including home trade), 0.56 cent per yard:

If stretched to within 1½ inches of grey width, 0.06 cent per yard extra.

(Class 2.)

½ inch extra grey width allowed on 50 inches and under, provided at least 1½ inches shrinkage is permitted.

1 inch extra grey width allowed over 50 to 60 inches, provided at least 2 inches shrinkage is permitted.

Pure calendered or assisted not exceeding 5 ounces filling for 12 yards, 0.56 cent per yard:

- Over 45 to 50 inches, per 12 yards and under, 7.85 cents.
- Over 50 to 55 inches, per 12 yards and under, 8.87 cents.
- Over 55 to 60 inches, per 12 yards and under, 10.01 cents.
- Other lengths in proportion.

(Class 3.)

Hard filled, or filled more heavily than limits in class 2:

- 41 to 42 inches, 14 yards and under, 10.01 cents.
- 38, 39, and 40 inches, 15 yards and under, 10.01 cents.
- Other lengths in proportion.
- Over 45 to 50 inches, per 12 yards, 12.17 cents.
- Over 50 to 55 inches, per 12 yards, 13.94 cents.
- Over 55 to 60 inches, per 12 yards, 15.58 cents.
- Other lengths in proportion.
- 0.51 cent up, every half yard extra.

Stitch marking or tambouring:

- Ordinary size, 3 marks, free.
- Ordinary size, each mark extra, 0.25 cent.
- Large size, all marks each, 0.25 cent.
- No reduction made when pieces are not stitch marked or tamboured.

JAVA CAMBRICS—FOR EXPORT TO JAVA ONLY.

$\frac{1}{2}$ inch extra grey width allowed on 50 inches and under, provided at least $\frac{1}{2}$ inches shrinkage is permitted.

1 inch extra grey width allowed over 50 to 60 inches, provided at least 2 inches shrinkage is permitted.

(Class 1.)

No starch or filling:

- Up to 45 inches, all lengths up to 15 yards, 6.69 cents; overlengths, 0.45 cent a yard extra.

(Class 2.)

Assisted—Not exceeding 6 ounces of starch or filling for 15 yards:

- Up to 45 inches, 7.25 cents, with 0.49 cent per yard extra for overlengths.
- Over 45 to 50 inches, 9.48 cents, with 0.63 cent per yard extra for overlengths.
- Over 50 to 55 inches, 10.59 cents, with 0.70 cent per yard extra for overlengths.
- Over 55 to 60 inches, 11.71 cents, with 0.77 cent per yard extra for overlengths.

(Class 3.)

Hard filled or more than 6 ounces of starch or filling for 15 yards:

- Up to 40 inches, 8.92 cents, with 0.61 cent per yard extra for overlengths.
- Over 40 to 45 inches, 9.48 cents, with 0.65 cent per yard extra for overlengths.
- Over 45 to 50 inches, 13.38 cents, with 0.89 cent per yard extra for overlengths.
- Over 50 to 55 inches, 15.06 cents, with 1.01 cents per yard extra for overlengths.
- Over 55 to 60 inches, 16.73 cents, with 1.12 cents per yard extra for overlengths.

HANDKERCHIEFS.

Common calender, pure, or slightly assisted finish (not finished nearer than 1 inch from grey width):

- Up to and including 41-inch grey, 0.56 cent per yard.
- Over 41-inch and not exceeding 48-inch, 0.68 cent per yard.
- Over 48-inch and not exceeding 54-inch, 0.82 cent per yard.
- If kept out to grey width, 0.06 cent per yard extra.

Beetled, calendered, or filled shirting finishes:

- Up to and including 41 inches, 0.68 cent per yard.
- Over 41 and not exceeding 48 inches, 0.82 cent per yard.
- Over 48 and not exceeding 54 inches, 0.95 cent per yard.

Lawn finish and special beetle finish:

- Up to and including 41 inches, 0.82 cent per yard.
- Over 41 and not exceeding 48 inches, 0.95 cent per yard.
- Over 48 and not exceeding 54 inches, 1.14 cents per yard.

Colored borders, plain handkerchiefs:

Up to and including 41 inches, 0.68 cent per yard.

Over 41 and not exceeding 48 inches, 0.82 cent per yard.

Over 48 and not exceeding 54 inches, 0.95 cent per yard.

Brocades, colored bordered brocades, leno and lace handkerchiefs and mufflers:

Up to and including 32 inches—

Scoured and white, 0.68 cent.

Cream and dyed ecru, 0.95 cent.

Other colors, 1.39 cents.

Over 32 to 41 inches—

Scoured and white, 0.82 cent.

Cream and dyed ecru, 1.14 cents.

Other colors, 1.52 cents.

Over 41 to 48 inches—

Scoured and white, 0.95 cent.

Cream and dyed ecru, 1.27 cents.

Other colors, 1.65 cents.

Over 48 to 54 inches—

Scoured and white, 1.14 cents.

Cream and dyed ecru, 1.65 cents.

Other colors, 2.28 cents.

Over 54 to 60 inches—

Scoured and white, 1.65 cents.

Cream and dyed ecru, 2.28 cents.

Other colors, 2.79 cents.

NOTE.—All colors unusually heavy and expensive will be subject to extra charge. For orders of less than 300 yards to a shade 25 per cent extra will be charged, such order to be of the same width, weight, and quality throughout.

A tab-end of not less than 15 inches must be allowed for finishing purposes at each end of a lump.

English contract prices for printing calico, 1911.

[Prices for 28/32 inch grey width.]

Style:	Cents per yard.	Blotch—Continued:	Cents per yard.
White ground—		Two colors.....	2.09
One color.....	1.52	Three colors.....	2.22
Two colors.....	1.52	Four colors.....	2.35
Three colors.....	1.65	Five colors.....	2.47
Four colors.....	1.77	Aniline black discharge:	
Five colors.....	1.90	One color.....	2.03
Fancy:		Two colors.....	2.16
One color..... tinted goods..	1.90	Three colors.....	2.28
Two colors..... do.....	2.03	Para red discharge:	
Three colors..... do.....	2.16	One color.....	1.90
Four colors..... do.....	2.28	Two colors.....	2.03
Five colors..... do.....	2.41	Indigo discharge:	
Blotch:		One color.....	2.28
One color.....	2.02	Two colors.....	2.28

These are the prices that are charged for taking the cloth in the grey and returning it printed.

DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 57

SHOE AND LEATHER TRADE ... IN ... FRANCE AND SWITZERLAND

By

ARTHUR B. BUTMAN

Commercial Agent of the Department of Commerce and Labor

TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD



WASHINGTON
GOVERNMENT PRINTING OFFICE
1912



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LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE AND LABOR,
Washington, August 7, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ended June 30, 1912, approved March 4, 1911, a report by Commercial Agent A. B. Butman, of this department, containing the result of his investigations of the shoe and leather trade in France and Switzerland.

Respectfully,

BENJ. S. CABLE,
Acting Secretary.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF MANUFACTURES,
Washington, June 6, 1912.

SIR: I have the honor to submit herewith a report by Commercial Agent Arthur B. Butman on the shoe and leather trade of France and Switzerland. His investigations followed the lines of work previously done in the United Kingdom and Germany, and included a study of the various factors influencing American trade, chief among which is the production of boots and shoes in native factories.

Respectfully,

A. H. BALDWIN,
Chief of Bureau.

To Hon. CHARLES NAGEL,
Secretary of Commerce and Labor.

SHOE AND LEATHER TRADE IN FRANCE AND SWITZERLAND.

FRANCE.

BOOT AND SHOE MANUFACTURING.

There are about 1,000 factories in France in which footwear is manufactured by machinery. Many, in fact most, of these are small establishments with limited equipment that can hardly be called modern. The more important factories, however, have complete installations of modern shoemaking machinery, and they turn out most creditable products. The output of the factories is steadily increasing and during the last two or three years especially there has been marked improvement in style, fit, and appearance.

The use of machinery in the manufacture of footwear is of long standing in France. About 1863 the Blake sole-sewing machine with fixed horn was manufactured and installed in considerable numbers by one Mr. Goodwin, of Paris, a machinery constructor. Mr. Godillot, the late army contractor, brought from the United States about 1865 an improved Blake sole-sewing machine with revolving horn. Two years later the Blake Sole-Sewing Machine Co., of London, through an agent in Paris, leased at a yearly rental about a dozen of these machines in various parts of France, and about 1873 the company established a branch in Paris. The use of American shoemaking machinery in France may be said to date from that time.

CHIEF MANUFACTURING CENTERS.

Paris, Nancy, Lyon, Nîmes, Marseille, Romans, Nantes, Fougères, Boulogne sur Mer, Amiens, and Liancourt are the principal manufacturing centers, although there are factories scattered all over the country. Shoe manufacturing, generally speaking, has always been an industry of importance in this country. Even at the time of the introduction of American machinery it was in a flourishing condition owing to the export trade. Manufacturing was largely by handwork; the rough stock was cut out by hand screw presses and heels were attached by a like method, the nails being driven from the inside of the shoe. The edges were trimmed in some cases by a machine (made by one Lemer cier), and when the soles were attached by screws this was done by a hand machine made by the same firm. The edges of the soles and heels of army shoes were burnished by wooden disks adapted to the Lemer cier machine.

"Handmade" shops, or "botteries" as they are termed in France, still exist, but their output at present is limited chiefly to high-grade expensive articles built for the ultraconservative among the well-to-do classes.

The shoemaking machinery installed in French factories is largely supplied by the United Shoe Machinery Co. of France, which is affiliated with the United Shoe Machinery Co. of Boston. In competition with this equipment are machines of French, English, and German origin, which combined constitute about 25 per cent of the total equipment.

A list of the more important boot and shoe manufacturers in France (those with a daily production of at least 100 pairs), with address and statement as to the nature and quantity of output, will be found on pages 40-42.

As the list given contains the names of only those having an output of at least 100 pairs daily, an incorrect impression may be gained of the importance of the various centers of manufacture, as well as of the total boot and shoe production of the country. In addition to those named there are many smaller factories turning out well-made products of various grades, the combined output of which is considerable.

A considerable quantity of so-called "mixed" work is manufactured in France. The term mixed is synonymous with fair-stitched, and means the attaching of the soles by two different machines. For example, the rand is attached to the upper and inner sole or middle sole by a staple tacker, or the middle sole or rand is nailed to the inner sole and upper, and afterwards the sole is stitched to the rand with a Goodyear Rapid stitcher.

CHARACTER OF OUTPUT.

Paris, Romans, and Limoges are the most important centers for high-class work, while articles of very good quality and style are produced at Toulouse. Nancy is a center of production for men's and women's ordinary-class boots, shoes, and slippers in both leather and felt. In Marseille a considerable quantity of boots, shoes, and slippers of ordinary quality is also made. The output of the Fougères factories is principally women's goods of a common class. Large quantities of rope-soled shoes are manufactured in the south of France. These are very cheap articles, the net cost of manufacturing the ordinary quality, with buckles or elastics, being \$1.16 per dozen pairs for women's sizes and \$1.35 for men's. Like articles of better quality are produced at a net cost of \$2.12 per dozen pairs for women's and \$2.32 for men's.

Most of the shoe factories in France are constructed with gallery floors, in some instances with two or three galleries one above the other; the lighter machinery is installed in these, which are lighted from above.

In factories not fully equipped with modern machinery, certain operations are accomplished by hand, including pulling over, pounding up, inseam trimming, welt-shank skiving, randing out heel seats, and cleaning uppers and stitches. Much work is also given out to house workers; in fact, I am told that probably 30 per cent of the total work of manufacture is still accomplished by workers in their homes. Female operatives are often employed in French factories in pulling over, pounding up, sole tacking, and finishing heels and edges.

More McKay-sewn boots and shoes are made than any other; mixed work holds second place, followed by Goodyear welt, turned, and nailed, in the order mentioned. There is comparatively little speciali-

zation, probably not more than 10 per cent of the manufacturers having specialized outputs.

French-made shoes are, on the whole, of good quality for grade and price. Most of the prominent manufacturers are now using American-shaped lasts and military or Cuban heels, although the French-style last, long and flat, with a low and medium heel for men's and a long toe with spring shank and Louis XV heel for women's goods, are employed to a certain extent. Glazed kid and box calf for men's and glazed kid, patent calf, and patent kid for women's lines are the principal leathers used.

LABOR CONDITIONS—WAGES.

The length of the working day for shoe operatives is usually 10 hours. Work commences at 6.30 a. m. and continues till 12 noon, with a half hour's rest from 8 to 8.30; work commences again at 1.30 p. m., and the day ends at 6.30 p. m. In some localities the hours are from 7 a. m. to 6 p. m. with an hour's rest at noon.

The labor cost in the boot and shoe industry is governed largely by locality, living conditions in the various towns where the industry centers influencing the scale of wages. Two systems of payment obtain, a fixed daily wage and the piecework system.

It is stated that the overcautiousness of the individual manufacturer as regards exceeding what is considered the standard rate of wage in his locality constitutes a great drawback to increased output. As a result of this prudence, individual employees operating certain machines, in turn, produce only what they individually or collectively consider sufficient, fearing a reduction in the piecework price should they increase their output.

A general idea of the labor cost in France may be obtained from the following lists of average wages paid in various towns:

Paris.

GOODYEAR-WELTED AND MCKAY-SEWN BOOTS AND SHOES.

Operations.	Rate.
Rough-stuff cutting.....per day..	\$1.35
Channelling:	
Goodyear soles.....do....	1.16-1.35
McKay soles.....do....	1.16-1.35
Sole molding.....do....	1.16
Channel opening for McKay.....do....	1.16
Gumming insoles, including lip turning and laying cloth.....per 100 pairs..	.77
Cutting, or clicking.....per pair..	.048
Upper fitting and stitching.....do....	.115
Counter skiving.....per day..	1.16
Box-toes skiving.....do....	1.16
Pulling over, by hand.....per pair..	.038-.048
Lasting on Consolidated.....per dozen pairs..	.162
Welt sewing on Goodyear machine:	
Men's.....do....	.154
Women's.....do....	.173
Sole sewing on McKay machine.....do....	.048
Inseam trimming.....do....	.077
Welt hammering.....do....	.019
Pounding up by hand after lasting for Goodyear.....per 100 pairs..	.772-.965
Filling and fixing shank pieces.....per dozen pairs..	.193
Sole laying (Goodyear).....do....	.077
McKay sole laying, taper tacker.....do....	.048
Rounding and channelling on last.....do....	.096
Shank skiving on last.....do....	.028
Channel opening on last.....do....	.028

Paris—Continued.

GOODYEAR-WELTED AND MCKAY-SEWN BOOTS AND SHOES—Continued.

Operations.	Rate.
Sole stitching (Goodyear Rapid):	
Men's.....per dozen pairs.....	\$0.154
Women's.....do.....	.173
Sole sewing (McKay) all around the forepart, including the shank.....do.....	.057
For the shank only.....do.....	.038
Channel laying.....do.....	.038
Beating out and leveling the soles.....do.....	.088
Nailing heel seats.....do.....	.019
Stitch separating, by machine.....do.....	.088
Heel stamping.....per 100 pairs.....	.144
Heel attaching.....per dozen pairs.....	.057
Toppiece slugging, by machine.....do.....	.038
Heel trimming.....do.....	.038
Heel breasting.....do.....	.038
Edge trimming (randing out included).....do.....	.135
Heel scouring.....do.....	.038
	.115
	.135
Inking and edge setting.....do.....	.154
	.173
	.193
	.212
Inking and finishing heels and seat wheeling.....do.....	.038
Sole buffing.....do.....	.048
Shank and sole buffing, by Naumkeag.....do.....	.057
Sole and shank finishing, including laying the colors.....do.....	.135
Cleaning up and taking out the last.....do.....	.194

UPPERS: STITCHING, SKIVING, FOLDING, AND ASSEMBLING.

Skiving on Amazeen machine (all articles).....per 100 pairs.....	\$0.396
Folding on Luffkin machine:	
Vamps.....do.....	.396
Upper for button boots.....do.....	.482
Bals and low-cut shoes.....do.....	.396
Tips.....do.....	.144
Marking sizes on lining and upper.....do.....	.144
Recess buttonholes (operative not supplying silk).....per 1,000 buttonholes.....	.390
Button sewing, by machine.....do.....	.193
Eyeloet setting, by power machine.....per 1,000 eyelets.....	.057
Fitting on block, one piece, men's and women's vamps.....per 10 pairs.....	.077

STITCHING, OPERATIVE PAYING FOR FINDINGS.

Operations.	Rate per 10 pairs.	
	With thread.	With silk.
LACE LOW-CUT SHOES.		
Stitching lining and upper together.....	\$0.019	\$0.038
Stitching inside back stays.....	.038	.048
Stitching top and front.....	.038	.057
Trimming and tying ends of thread.....	.019	.038
Stitching lining to the vamp.....	.019	.019
Vamping.....	.048	.066
Top stays.....	.019	.038
BUTTON BOOT, SQUARE VAMP.		
Lining.....	.048	.048
Assembling.....	.038	.038
Stitching inside back stays.....	.066	.096
Stitching outside back stays.....	.038	.048
Vamping.....	.096	.144
Vamp closing.....	.077	.096

Paris—Continued.

DIVIDED WORK, LADIES' UPPERS, SQUARE VAMPS.

Operations.	Rate per 6 pairs.	
	With thread.	With silk.
Skiving.....	\$0.023	\$0.023
Folding.....	.067	.067
Lining.....	.048	.048
Assembling.....	.038	.038
Stitching inside stays.....	.066	.066
Stitching outside back stays.....	.028	.048
Vamping.....	.096	.144
Vamp closing.....	.077	.096
	.433	.550

The price per 1,000 for buttonholes, the operative supplying the silk at \$5.62 per 2.2 pounds, the cord, and the needle, is \$0.772; if the operative does not supply the findings, \$0.289. If silk at \$11.24 per 2.2 pounds is used, the rate is \$0.965 per 1,000 buttonholes.

Nancy.

GOODYEAR-WELTED AND MCKAY-SEWN BOOTS AND SHOES.

Operations.	Rate.
Rough-stuff cutting..... per day..	\$0.675 - \$1.16
Channeling Goodyear soles..... per dozen pairs..	.0096
Channeling McKay soles..... do.....	.0096
Sole molding..... {per day.....	.579
Channel opening for McKay ¹ {per dozen pairs..	.0067 - .0077
Gumming insoles..... do.....	.0038 - .0077
Cutting or clicking..... {per dozen pairs uppers..	.0096 - .0135
Upper fitting..... {per day.....	.386 - 1.16
Upper stitching..... per dozen pairs..	.096
Counter skiving..... do.....	.386 - .675
Box-toes skiving..... do.....	.0067
Pulling over, by hand and machine..... per pair..	.0096 - .0193
Lasting on Consolidated machine..... do.....	.0096 - .0135
Welt sewing on Goodyear machine..... per day..	.965 - 1.25
Sole sewing on McKay machine..... per dozen pairs..	.028 - .057
Inseam trimming..... per day..	.579 - .675
Welt hammering..... do.....	.579 - .675
Pounding up by hand after lasting for Goodyear..... do.....	.579 - .868
Filling and fixing shank pieces..... per dozen pairs..	.115 - .144
Sole laying (Goodyear)..... per day..	.965 - 1.16
McKay sole laying by taper tacker ² per dozen pairs..	.0067 - .0135
Rounding and channeling on last..... per day..	.965 - 1.16
Shank skiving on last..... do.....	.386 - .482
Channel opening on last..... do.....	.386 - .482
Sole stitching (Goodyear Rapid)..... do.....	1.06 - 1.16
Beating out and leveling the soles ³ per dozen pairs..	.048 - .096
Nailing heel seats..... per day..	.579 - .675
Stitch separating, by machine..... do.....	.579 - .675
Heel stamping..... do.....	.772 - .868
Heel attaching..... {per dozen pairs..	.772 - .868
Top slugging, by machine..... per day..	.579 - .772
Heel trimming..... do.....	.772 - .965
Heel breasting..... do.....	.772 - .965
Edge trimming..... do.....	.965 - 1.16
Heel scouring..... do.....	.579 - .675
Inking and edge setting..... {per dozen pairs..	.386 - .965
Inking and finishing heels and seat wheeling..... per day..	.579 - .868
Sole buffing..... {per dozen pairs..	.386 - .675
Shank and sole buffing, by Naumkeag..... per day..	.386 - .675
Sole and shank finishing, including laying the colors..... per dozen pairs..	.019
Cleaning up and taking out the last..... per day..	.482 - .868
	.386 - .675

¹ In some factories this work is done by the lasters.

² Operator pays for the tack strip out of this amount and takes out the lasts.

³ Channel laying is included in the operation of beating out and leveling the soles.

Nancy—Continued.

UPPERS: WORK PREPARED AND STITCHED BY SAME WOMAN, SKIVING DONE SEPARATELY.

Operations.	Rate per pair.	
	With thread.	With silk.
Lace shoes:		
Vamp stitched on to the quarters	\$0.0347	\$0.0386
Folded vamp	.0386	.0424
Button shoes:		
Vamp stitched on to the quarters	.0386	.0424
Folded vamp	.0463	.65
Tips (extra)	.0067	.0067
Imitation tips (extra)	.0028	.0028
Low-cut shoes, 3 button:		
Folded	.0424	.0463
Nonfolded	.0386	.0424
Goatskin slippers	.028	
Felt slippers	.015	
Babies' felt shoes	.02	
Girls' uppers, 3 rows stitching	.0386	.04
Stitching of women's uppers:		
Lace boot	.0279	.0318
Lace boot, stitching right round the vamp, imitation tip	.0386	.0386

NOTE.—Nondivided work: Preparation, vamp to be stitched over the quarters, \$0.0347 per pair; vamp to be stitched under the quarters, \$0.0386.

Brittany.

MEN'S BOOTS.

Operations.	Rate.
Pulling over:	
Nonlined, split-leather articles	per pair. \$0.0183
Canvas or linen lined, including first trimming	do. .023
Operator on Consolidated lasting machine	do. .0965
Welt sewing	per hour. .0965
Pounding up and toe trimming	per pair. .0086
Filling and sole laying	do. .0328
Sole stitching (Goodyear Rapid)	per hour. .0965
Taking out the last and leveling, by hand	per pair. .0115
Heel screwing and top piece attaching, by hand	do. .023
Randing and edge and shank trimming	per dozen pairs. .0965
Heel trimming	do. .019
Heel scouring and joining	do. .048
Edge setting	do. .1158
Sole and top piece buffing	do. .0386
Sandpapering	do. .0386
Inking and heel and shank finishing	do. .0579
Inking and sole finishing	do. .0965
Treeling	do. .1158

WOMEN'S COMMON-CLASS MIXED WORK (IN FOURGÈRES).

Tacking on and nailing round middle sole with staple tacker	per pair.	\$0.0038
Wire	do.	.0019
Stitching forepart with Goodyear Rapid	do.	.0048
Thread	do.	.0048
Royalty, Red Rapid (small stitch)	do.	.0048
Nailing shank in channel with staple tacker	do.	.0027
Wire	do.	.0011
Total		.0339

NOTE.—The above prices for women's common-class mixed work can be obtained where there is sufficient work to organize properly. Of course, this cost would all be in addition to that of lasting an ordinary McKay shoe.

North of France (Glageon).

HEAVY BROGANS.

Operations.	Rate per 100 pairs.
Assembling, tacking on inner soles included.....	\$0.386
Pulling over (Rex).....	.289
Lasting (Consolidated).....	.772
Pounding up (Rex).....	.193
Sole laying (loose nailer).....	.193
Sole nailing (loose nailer) once round.....	.193
Royalty.....	.87
Total.....	2.896

NOTE.—Men earn at least \$1.16, and boys \$0.48 per day.

COST OF LASTING SLIPPERS AT PONT-DE-L'ARCHE (NEAR ROUEN).

The operator on the Consolidated machine is paid by piecework at the rate of 5.4 cents per dozen pairs. This includes the pulling over and lasting, leaving the slipper ready to have the sole tacked or stuck on. Out of this price the operator has to pay a young man for pulling over; this operation consists of putting in the stiffener, one tack at the toe, and one tack on each side of the toe. The rate of 5.4 cents per dozen pairs is for sizes up to No. 7, inclusive (about 45 cents a hundred); above these sizes it is 7.14 cents per dozen pairs.

These wages are increased by 1.35 cents a dozen pairs if there is any patent leather at the toes or wings of the uppers. Each operator on the lasting machine does from 35 to 40 dozen pairs a day.

One boy sticks the filling on the sole at the rate of 60 to 70 dozen pairs a day for 1.35 cents a dozen pairs, and the soles, after being thus prepared, are stuck, under a small press, to the shoe; for the latter operation, also at the rate of 60 or 70 dozen pairs per day, the wage is 1.35 cents per dozen pairs.

COST OF BOTTOMING MEN'S FIRST-CLASS WORK IN FRANCE.

Operations.	Rate per 100 pairs.	Operations.	Rate per 100 pairs.
Tacking on insoles.....	\$0.2895	Heel attaching.....	\$0.434
Sticking box toes and counters.....	.1447	Toppiece slugging.....	.2895
Assembling.....	.386	Heel trimming.....	.193
Pulling over (Rex) ¹	.579	Heel breasting.....	.26
Lasting on Consolidated ¹	1.25	Pounding up heel seats.....	.3377
Pounding up toes and heels, by hand.....	.675	Stitch separating.....	.386
Welt sewing.....	.965	Edge trimming.....	.82
Inseam trimming.....	.48	Heel scouring ¹	.434
Welt shank skiving.....	.1447	Heel and heel-breast buffing.....	.2895
Welt hammering.....	.193	Jointing shanks and heels.....	.154
Filling.....	.772	Edge setting.....	1.25
Sole laying.....	.48	Sole buffing and cleaning on Naumkeag ¹	.549
Rounding and channeling.....	.675	Finishing heels and seat wheeling.....	.386
Shank skiving and channel opening.....	.386	Sole finishing.....	.772
Sole attaching on Goodyear Rapid and randing.....	1.06	Inking.....	.24
Nailing and trimming heel seats.....	.48	Cleaning up, treeing.....	.87
Channel laying.....	.1447	Taking out the last.....	.2895
Sole beating and leveling.....	.386	Sticking sock lining.....	.193

¹ Findings paid for by operator.

COST OF MANUFACTURING HEELS.

The following statements show the average cost of labor in France on the manufacture of heels. Lifts are cut out by men earning an average of \$0.965 per day, and heels are built by women earning \$0.48.

The prices given are the average paid in shoe factories. Heel manufacturers pay a little less, perhaps 10 per cent less on the building, but the price of cutting remains the same. Stamping the heels on No. 4 compressor is paid for at the rate of 2.12 cents per 100 pairs.

Operations.	Rate.
CUTTING OUT LIFTS.	
Leather heel lifts, in one piece.....per pound..	<i>Cents.</i> 1.27
Heel lifts, in several pieces.....do.....	2.54
Heel lifts of cardboard and artificial leather.....do.....	.52
Attaching sectional heel lifts by machine.....do.....	.69
BUILDING OF HEELS.	
Men's 6/8.....per 100 pairs..	10.6
Men's 8/8.....do.....	14.4
Men's and women's 10/8.....do.....	19.3
Women's Cuban and hollow 12/8.....do.....	24
Women's Louis XV.....do.....	33.77

LABOR COST AT LEROY FACTORY.

The actual cost of labor on a well-known shoe called the "Incroyable," manufactured at the factory of A. Leroy, Nancy, and retailing at \$1.93 per pair, is as follows:

Operations.	Rate.	Operations.	Rate.
Tacking on insoles (500 pairs).....per day..	\$0.386	Heel trimming.....per 10 pairs..	\$0.0193
Assembling counters and toes (500 pairs).....per day..	.48	Edge trimming.....do.....	.0386
Pulling over on machine (500 pairs).....per day..	1.25	Sandpapering heels.....do.....	.028
Consolidated lasting.....per 100 pairs..	1.06	Sandpapering heel breast.....do.....	.0193
Pounding up, tacking the soles, and tacking out the lasts.....per 100 pairs..	1.109	Edge setting.....do.....	.0772
Sewing on McKay machine.....per 10 pairs..	.0386	Imitation stitch wheeling.....do.....	.0193
Leveling.....do.....	.0579	Sandpapering top lifts.....do.....	.0386
Heeling.....do.....	.023	Sandpapering soles.....do.....	.0193
Universal slugging.....do.....	.0096	Coloring soles.....do.....	.0386
Breasting.....do.....	.0096	Finishing the soles.....do.....	.0386
Relasting.....do.....	.0154	Heel-seat heading.....do.....	.0386
		Cleaning the uppers.....do.....	.0386
		Treeing and taking out lasts.....do.....	.1158

LABOR COST AT LEVY FACTORY.

The cost of labor at the factory of A. & J. Levy, Nancy, for McKay and mixed work is as follows:

Operations.	Rate.	Operations.	Rate.
Tacking insoles (500 pairs).....per day..	\$0.386	Slugging.....per dozen pairs..	\$0.0077
Sticking counters (500 pairs).....do.....	.386	Power heel breasting.....do.....	.077
Sticking toes (500 pairs).....do.....	.434	Relasting.....do.....	.0135
Assembling uppers.....do.....	.965	Heel trimming.....do.....	.0154
Operator on pulling over machine (500 pairs).....per day..	1.25	Plowing out the edges.....do.....	.0154
Consolidated McKay.....per 100 pairs..	.87	Edge trimming.....do.....	.0154
Pounding up on rotary machine (500 pairs).....per day..	.579	Heel scouring.....do.....	.0212
Filling and shanks.....do.....	.53	Heel-breast scouring.....do.....	.0057
Tacking middle soles on the staple tacker.....per 100 pairs..	.2896	Jointing shanks and heels.....do.....	.0077
Tacking soles (taper tacker).....do.....	.24	Edge setting.....do.....	.0065
Rapid stitching.....per dozen pairs..	.028	Sole sandpapering.....do.....	.0135
McKay sewing (400 pairs).....per day..	.965	Sandpapering top lifts.....do.....	.0057
Leveling.....per dozen pairs..	.0579	Buffing shanks.....do.....	.0057
Stitch separating.....do.....	.0077	Blacking the soles and heels.....do.....	.0077
Heeling.....do.....	.0386	Finishing heels.....do.....	.0057
		Finishing soles.....do.....	.048
		Heel-seat heading.....do.....	.0077
		Treeing and pulling out the lasts.....do.....	.0065

LABOR COST AT MARTIN & PICARD FACTORY.

The cost of labor at the factory of Martin & Picard, Nancy, is shown by the following statement:

Operations.	Rate.	Operations.	Rate.
Preparing for the lasting (500 pairs) per day.....	\$0.579	Slugging..... per 100 pairs..	\$0.0965
Pulling-over operator..... per day..	1.16	Heel trimming (man finds the knives) per 100 pairs.....	2895
Consolidated lasting:		Heel breasting..... per 100 pairs..	.077
Men's..... per 100 pairs.....	1.16	Sandpapering heels (woman pays for sandpaper)..... per 100 pairs..	.386
Women's and girls'..... do.....	.772	Edge trimming..... do.....	.965
Leveling..... do.....	.289	Edge setting..... do.....	.579
Filling and putting in shanks (200 pairs) per day.....	.579	Scouring and buffing (woman pays for sandpaper)..... per 100 pairs..	.386
Tacking soles on taper tacker, per 100 pairs.....	.24	Coloring..... do.....	.193
McKay sewing..... per 100 pairs.....	.2895	Finishing..... do.....	.579
Leveling..... do.....	.772	Treering and pulling out the lasts.....	.965
Heeling (man finds the nails)..... do.....	.328		

LABOR COST AT NOUGAYROL FACTORY.

The cost of labor at the Nougayrol factory, Toulouse, for McKay and mixed work is shown in the following:

Operations.	Rate per 100 pairs.	Operations.	Rate per 100 pairs.
Looking up lasts.....	\$0.0965	McKay sewing in the shanks.....	\$0.1447
Laying insoles.....	.0965	Cementing and channel closing.....	.1447
Stitching in counters, box toes.....	.386	Automatic leveling out the soles.....	.24
Pulling over.....	.24	Heel nailing on Lightning heeler.....	.193
Consolidated lasting.....	.579	Top lift slugging on Universal machine..	.1447
Pounding up and toe trimming.....	.193	Heel trimming.....	.1158
Covering up.....	.2895	Heel breasting.....	.0965
Filling and putting in shanks.....	.386	Edge and edge-shank trimming.....	.48
Tacking middle soles.....	.0965	Heel scouring.....	.386
Welt tacking on staple tacker.....	.48	Edge setting.....	.386
Sole laying, taper tacker.....	.193	Sole scouring.....	.193
Rough rounding on mixed work.....	.386	Naumkeag buffing.....	.0965
Channel opening on the last.....	.0965	Blacking.....	.193
Stitching the forepart.....	.386	Sole finishing.....	.386
Stitching all round.....	.579	Treering, by machine.....	.2895
Tacking the toes.....	.0965	Heel-seat beading.....	.0772
Tacking the heel seats.....	.0965	Sticking the insoles.....	.048
Pulling out the lasts.....	.2895	Stitch separating, by hand.....	.048
McKay sewing all around.....	.2895	Taking off the covers.....	.579

COST OF LABOR IN FACTORY AT TOURS.

A Tours manufacturer of a woman's laced Richelieu shoe, McKay-sewn, with a 6/8 heel, single sole, and with an entire middle sole of cardboard, gets this class of work lasted by hand (by women) ready for sewing on the McKay machine, channels not opened, at 15.4 cents per dozen pairs, and each woman earns at this rate from 57.9 to 77.2 cents per day. The same class of shoes, with an 11/8 heel and a patent-leather toe cap (the woman finding lasting tacks and paste for pasting in the box toe), is paid for at the rate of 18.29 cents per dozen pairs; this increase in price is due to a shank piece in wood or cardboard, the toe cap not being of first-class leather. Only 4 dozen pairs of this description can be produced daily by a woman. These articles are sold in retail shops at 95.5 cents for the former, and \$1.15 for the latter. The manufacturer produces daily 200 dozen pairs.

COMPLETE COST IN TOULOUSE FACTORY.

A general idea of the labor cost will have been gained from the foregoing statements. It is difficult to formulate an exact cost statement for France as a whole, since, as already stated, wages vary. I have, however, been furnished the following statement of the labor cost of a good grade of men's and women's shoes (high cuts) Goodyear-welted, as made at Toulouse, which may perhaps be considered a fair average for the country on similar goods. The statement embraces all items, both hand and machine labor, from cutting out bottom stuff and uppers to placing in cardboard boxes ready for shipment.

Operations.	Cost per pair.	Operations.	Cost per pair.
DIEING OUT ROUGH STUFF FOR BOTTOMING.		SEWING WELT AND STITCHING SOLE, ETC.—continued.	
Operative (paid an average of \$1.44 for dieing out soles, inner soles, counters, and box toes from 220 pounds of suitable leather).....	<i>Cents.</i> 0.96	Sewing in welt.....	<i>Cents.</i> 0.866
HEELS.		Welt hammering.....	.144
Dieing out lifts.....	.63	Skiving welt in shank.....	.144
Building.....	.01	Fixing shank pieces.....	.144
Compressing on No. 4 compressor (2.5 cents per 100).....	.025	Bestos filling.....	.386
Total.....	.755	Sole laying.....	.289
UPPERS.		Rough rounding and channeling.....	.675
Dieing out by Ideal press.....	1.35	Shank skiving.....	.193
Cutting linings by hand knife.....	.007	Opening outsole channel.....	.135
Fitting, skiving, folding, and stitching complete (cost of silk included), button boot.....	8.299	Stitching on outsole.....	.868
Total.....	9.656	Total.....	4.106
PREPARATION.		HEEKLING AND FINISHING.	
Channeling inner soles.....	.115	Heel-seat nailing.....	.144
Gumming, including lip turning.....	.772	Cementing outside channels.....	.096
Skiving counters.....	.096	Closing outsole channels.....	.193
Skiving box toes.....	.096	Leveling soles on Auto leveler.....	.386
Total.....	1.079	Heel-seat trimming.....	.096
LASTING.		Imitation stitch wheeling (2 operations).....	.386
Selecting lasts.....	.096	Heel attaching (Lightning heeler).....	.337
Tacking on inner soles.....	.096	Toppiece slugging.....	.289
Fitting counters, pasting box toes (assembling).....	.482	Heel trimming.....	.289
Pulling over, on machine.....	.386	Heel breasting (power breaster).....	.198
Lasting (Consolidated machine).....	.868	Shank and edge trimming.....	.579
Covering uppers.....	.289	Finishing junction of heel breast and shank.....	.289
Total.....	2.217	Heel-breast scouring.....	.579
SEWING WELT AND STITCHING SOLE, ETC.		Edge and shank-edge finishing.....	.579
Tack pulling and upper trimming.....	.019	Sandpapering sole and topiece.....	.289
Inseam trimming.....	.241	Buffing soles and topieces (Naumkeag).....	.144
		Coloring soles, edges, and heels.....	.241
		Finishing soles.....	.482
		Heel finishing and seat wheeling (Xpedite machine).....	.241
		Removing cover from upper.....	.579
		Pulling out last and treeing.....	.289
		Pasting in sock lining.....	.048
		Cleaning linings.....	.096
		Placing in cardboard boxes (250 pairs per day at 38.6 cents).....	.154
		Total.....	6.906
		Grand total.....	25.771

COST OF PRODUCTION IN VARIOUS CITIES.

One manufacturer in Marseille making 450 pairs per day of all-round McKay work employs 155 hands, as follows: 75 men at \$1 per day, 10 youths at 38.6 cents, 55 women at 54 cents, and 15 girls at 24 cents. His output costs for labor, from the cutting of rough stock to placing in cartons, 24.7 cents per pair for both men's and women's goods.

In the same town another manufacturer employs 290 hands and produces 180 pairs of Goodyear-welt and 645 pairs of McKay work daily. He pays in daily wages: 140 men at 91.6 cents, 30 youths at 33.7 cents; 85 women at 51 cents, and 35 girls at 24 cents. His boots and shoes cost for labor, from rough-stuff cutting to putting in cartons: Men's and women's Goodyear welt, 27.4 cents per pair; men's and women's McKay-sewn, 21.2 cents.

In Limoges for high-class work, the cost of labor from cutting of rough stock to placing in cartons, on men's and women's Goodyear-welt work is 51 cents per pair; on men's and women's McKay-sewn, 47.2 cents per pair. The following daily wages are paid: Men, \$1.158; youths, 57.9 cents; women, 53.7 cents; girls, 33.7 cents.

In Romans the rate of wages is: Men, 86.8 to 96.5 cents; youths 19.3 to 38.6 cents; women, 48.2 to 67.5 cents; girls, 19.3 to 38.6 cents. The labor cost on a pair of men's boots (all operations and placed in cartons), very high-class work, Goodyear-welt is 51 cents. Another Romans firm's labor cost for women's Goodyear-welt work is 57.9 cents per pair; McKay-sewn, 50.18 cents, and cheaper-grade McKay-sewn, 48.2 cents.

SALES SYSTEM—LABOR ORGANIZATIONS.

A number of manufacturers maintain retail stores for the disposition of their products. The terms usually given to dealers by French manufacturers vary; some give 30 days, others 60, and still others 90 days, without counting the month of the invoice. In addition, 2 or 3 per cent is also granted in certain instances.

In France, as in other countries, labor difficulties are more or less frequent in the shoe industry. In the chief centers of manufacture the employers have an association known as "Chambre Syndicale," and the employees likewise have syndicates, or unions. In Fougères, for example, the workmen not only have their syndicate but also a bourse du travail, corresponding to the central labor union or trades council in the United States. Within the last few years the latter organization has erected a house in which there is a hall for meetings and a theater. The syndicate in Fougères, in fact, is one of the most completely organized in France. Labor troubles are frequent, a week rarely passing without some quibble between masters and men. The operatives are somewhat opposed to the use of machinery, particularly the cutters against the clicking press.

COST OF BUILDINGS—POWER—EXPORT STATISTICS.

As to the cost of building sites and the construction of factories in France, I am informed that in provincial towns such as Nancy, Romans, and Limoges, the average cost of land is about 10 francs per square meter (\$1.61 per square yard). The cost of building a one-story factory with light walls, inside fulcrums of light columns, roof of iron tiles and glass, with cemented ground, is reckoned at about 100 francs per square meter (\$16.14 per square yard) for large surfaces; if there are two stories, 200 francs per square meter (\$32.28 per square yard); if three stories, 300 francs per square meter (\$48.42 per square yard).

Rentals are reckoned at about 8 per cent of the value of the factory building. City taxes amount to about 10 per cent of the rental paid. Shoe manufacturers are also taxed according to the number of machines used and workmen employed. For each machine worked by hand the tax is \$1.16 per year; for each power machine, \$2.32; for each workman employed, 58 cents.

The motive power used is approximately as follows: Electricity, 70 per cent; water gas, 15 per cent; steam, 10 per cent; city gas, 5 per cent.

During 1910 the exports of boots and shoes of domestic manufacture from France were valued at \$2,123,771. The quantities exported to various countries were as follows:

Countries.	Pounds.	Countries.	Pounds.
Belgium.....	213,840	Turkey.....	58,300
Egypt.....	30,800	United Kingdom.....	143,880
French possessions.....	1,165,560	All other countries.....	174,900
Germany.....	54,780		
Morocco.....	73,920	Total.....	2,017,400
Switzerland.....	101,420		

HIDE AND SKIN TRADE.

Imports of hides and skins into France exceed exports, as a whole, but exports of sheep, lamb, and calf skins are greater than the imports. The following table shows the quantity and value of the imports and the value of the exports during 1910:

Articles.	Quantity.	Value.
IMPORTS.		
	<i>Pounds.</i>	
Raw hides, wet or dry.....	114,399,560	\$20,059,025
Sheep and lamb skins.....	5,571,940	887,261
Goat and kid skins.....	24,836,020	8,889,380
Calfskins.....	9,316,560	3,759,655
Other small skins.....	1,421,880	658,792
Total.....	155,545,960	34,254,123
EXPORTS.		
Large hides.....		10,455,534
Sheep and lamb skins.....		2,896,203
Goat and kid skins.....		2,728,800
Calfskins.....		5,373,444
Other hides and skins.....		824,559
Total.....		22,278,530

Reexports of hides are small, most of the imports being retained for consumption in the country.

COUNTRIES SUPPLYING IMPORTS.

The source of the imports is indicated in the following table:

Articles and countries.	Pounds.	Articles and countries.	Pounds.
RAW HIDES, WET OR DRY.		GOAT AND KID SKINS—continued.	
Argentina.....	4,907,980	French possessions.....	2,615,360
Belgium.....	11,159,060	Germany.....	1,181,400
Brazil.....	15,700,740	Italy.....	1,098,680
British India.....	2,324,300	Morocco.....	1,621,620
Chile.....	7,666,340	Russia.....	1,151,920
China.....	5,778,300	Spain.....	2,978,140
French possessions.....	9,600,140	Turkey.....	1,878,140
Germany.....	9,323,160	United Kingdom.....	683,760
Italy.....	8,537,100	All other countries.....	3,823,380
Mexico.....	2,359,500		
Netherlands.....	2,806,540	Total.....	24,836,020
Peru.....	1,744,000		
Spain.....	2,314,020		
Switzerland.....	2,739,880	CALFSKINS.	
United Kingdom.....	2,608,760	Argentina.....	433,620
United States.....	5,686,340	Australia.....	340,120
Uruguay.....	7,908,120	Austria-Hungary.....	1,012,880
All other countries.....	11,234,080	Belgium.....	1,045,000
Total.....	114,399,560	French possessions.....	51,480
		Germany.....	2,925,120
SHEEP AND LAMB SKINS.		Italy.....	565,840
Argentina.....	2,273,480	Netherlands.....	565,180
Belgium.....	669,900	Russia.....	410,520
French possessions.....	639,980	Switzerland.....	461,560
Germany.....	300,520	United Kingdom.....	360,360
Russia.....	181,500	Uruguay.....	772,200
Spain.....	400,840	All other countries.....	372,680
Switzerland.....	568,480		
United Kingdom.....	125,400	Total.....	9,316,560
All other countries.....	411,840		
Total.....	5,571,940	OTHER SMALL SKINS.	
		Austria-Hungary.....	53,680
GOAT AND KID SKINS.		Belgium.....	148,500
Argentina.....	1,478,840	British India.....	93,940
Austria-Hungary.....	799,920	French possessions.....	41,140
British India.....	4,143,040	Germany.....	625,900
China.....	669,680	Russia.....	94,380
Egypt.....	712,140	Switzerland.....	57,420
		United Kingdom.....	200,220
		All other countries.....	106,700
		Total.....	1,421,880

EXPORTS—PRICES—SALES METHODS.

Exports of hides and skins from France are chiefly steer and horse hides, with small quantities of bull and cow hides. Hides and skins are sold at public auction, with official catalogues and printed report of the sales; also by mutual agreements renewed either monthly or annually.

Prices of raw hides and skins vary widely, according to the season, region of the country, and condition. Prices in Paris on March 1, 1912, for fresh hides, with skulls and horns, taken at the shambles, were as follows per 100 pounds: Oxen, \$12.30; cow, \$11.60; bull, \$10.35; calf, \$19.25. These prices were obtained at public sales and are an increase of about 20 per cent over those of 10 years ago.

All sales for export are understood firm, and paid cash against documents, or on bankers' credit three or four months' sight. A few French concerns having branches abroad consign hides and skins to these branches, but this is rather exceptional and is not considered a sale.

The hide and skin market in France is at present (April, 1912) very firm and active. In 1911 (detailed statistics for which are not yet published) the country still imported a larger quantity of hides and

skins than it exported, while the only countries to which exports are increasing are Germany and the United States.

TANNING INDUSTRY.

There is no official industrial census in France and it is therefore difficult to state accurately the number of tanneries; but there are approximately 1,000 scattered throughout the country. Probably about 50 per cent of these are worked by machinery, the remainder being small concerns employing no more than 8 or 10 persons and working with the old process.

There is more or less specialization in manufacture, grouped under the usual heads, namely, upper leather, sole leather, leather belting, fancy leather, and glove leather. The names and addresses of some of the principal tanning firms in each of the classes mentioned, except glove leather, with a statement as to the nature and quantity of their daily output, are given on page 43.

Three-fourths of the output of the upper-leather tanners is mineral and one-fourth vegetable tannage. The sole leather is chiefly of oak and chestnut bark tannage, and the leather belting oak bark. Most of the fancy leather is of sumac tannage for bookbinding, moroccas, fancy articles, etc.

TANNING CENTERS—RAW MATERIALS—WAGES.

The chief centers for glove-leather manufacture are Grenoble, with about 30 tanneries having individual daily outputs of 200 dozen small goat and lamb skins; Annonay, with 10 factories of about the same capacity; Millau, with 20 factories, and St. Junien, with 10 factories.

It must not be inferred that the entire number of tanneries in this country previously mentioned as working with machinery are fully equipped with modern machinery. Many are comparatively small establishments, with equipments scarcely modern. The fair-sized tanneries have modern machinery, and the larger and more important plants have full modern equipment and employ large numbers of workpeople. The French tanner, in general, is very conservative.

While no statistics are available as to the annual consumption of raw material (hides and skins), an idea of the approximate quantity worked may be gained by comparing the annual slaughter in France, figures for which are published by the Department of Agriculture, with the exports of domestic hides and skins, and imports from foreign countries, previously given. The annual slaughter in France is as follows: Oxen, cows, and bulls, 1,950,000; heifers, 187,000; calves, 3,522,000; sheep, 7,000,000; lambs, 1,434,000; goats and kids, 1,030,000.

The time required for tanning sole and belting leather varies greatly. Many tanners take from six to nine months, others from three to five months, and a few from one to two months. Box calf, goat, and sheep skin manufacturers turn out their stocks, as a rule, in from four to six weeks' time.

Confronted by the gradual increase in prices of raw material, the tanner here, as in Germany, complains of his inability to do business with even fair profit. Ten or fifteen years ago the French tanner held a very enviable position, owing to his ability to secure the specially good home pelts that are now being sought by foreign buyers at prices the French tanner considers exorbitant.

In the Department of the Seine, Paris and its vicinity, 10 hours constitute a days' work, and a tanner or currier receives up to \$1.54

daily. The average, however, is \$1.16 for men and \$0.58 for women. These wages are considered high for France, being necessitated by the present high cost of living. In 1860 the daily wage for men was 87 cents and in 1900 it was \$1.06.

In the Provinces a day's work is from 10½ to 10¾ hours; the average daily wage for men is 77 cents and for women 39 cents.

LEATHER IMPORTS AND EXPORTS.

The following table shows the value of the imports into and exports from France of partially and wholly prepared and finished leathers during 1910:

Articles.	Imports.	Exports.
Goat, sheep, and lamb skins, tanned or tawed only.....	\$1,803,382	\$3,158,454
Other skins, tanned or tawed only.....	3,951,935	3,168,809
Calfskins, finished or ready to finish, tawed or prepared by vegetable tannage...	309,041	866,415
Goat, kid, sheep, lamb, calf skins, etc., of natural color, dyed, or black.....	1,103,303	11,023,774
Cow and other large hides.....	555,801	1,176,315
Goat, sheep, and lamb skins, prepared by mineral tannage.....	1,194,670	213,404
Other skins, prepared by mineral tannage.....	1,244,155	200,623
Varnished or japanned leather.....	1,001,320	627,423
Leather, prepared and finished, not otherwise specified.....	783,271	542,899
Leather belting.....	435,522	485,945
Total.....	12,382,400	21,464,061

LEATHER TRADE.

The American leather trade with France is seriously handicapped by the fact that most American products are subject to the general, or highest, tariff rates. The only American leather entering under the minimum tariff is vegetable-tanned waxed calf, which is now seldom manufactured by tanners in the United States. In the following table, giving the tariff on leather, the special rates accorded the United States are printed in italics; otherwise the general rates are applicable.

Tariff No.	Articles.	General tariff.	Minimum tariff.
476	Hides and skins, prepared: By vegetable tanning or tawed— Merely tanned or tawed— Goat, kid, sheep, and lamb skins.....	<i>Per 100 pounds.</i> \$1.31	<i>Per 100 pounds.</i> \$0.88
	Other— Neither split nor fleshed— Untrimmed.....	4.38	2.19
	Backs.....	5.25	2.81
	Leavings and flesh splits.....	3.50	1.58
	Split or fleshed: <i>Dutiable as the tanned hide or skin, according to kind, plus.....</i>	.88	.26
	Curried— Calfskins, waxed or ready to be waxed, but not having undergone any of the processes mentioned in the following paragraph.....	6.57	¹ 4.38
	Goat, kid, sheep, lamb, calf, and other skins, of natural color, dyed or blackened in the bath or by the brush, sleeked, grained, checkered, stamped, moroccoed, glossed, or dull...	7.88	5.25
	Cow and other hides, dyed or blackened in the bath or by the brush, sleeked, grained, checkered, stamped, moroccoed, glossed, or dull.....	7.00	4.38
	<i>Imports originating in the United States and Porto Rico.....</i>	<i>6.13</i>	.....
	Trimmed for fine saddlery, and pigskins of natural color, black, browned, or dyed ²	6.57	3.50
	Sheepskins, prepared in Europe or elsewhere from raw skins from non-European countries, not pared, dyed, dull, or sleeked, for shoe linings, etc.....	7.00	3.94
	<i>Imports originating in the United States and Porto Rico.....</i>	<i>6.13</i>	.....

¹ Applies to imports originating in the United States and Porto Rico.

² Limitation pigskin obtained by stamping cow or other hides dutiable as "Other prepared hides and skins not specified."

Tariff No.	Articles.	General tariff.	Minimum tariff.
476	Hides and skins, prepared—Continued. Hides and skins, mineral tanned, other than those exclusively alum tanned— Goat, kid, sheep, or lamb: <i>Rates applicable to the hide or skin, according to kind, increased</i> Other: <i>Rates applicable to the hide or skin, according to kind, increased</i> Patent leather ¹ Chamois-dressed or parchment-dressed leather, dyed or not, or tawed and dyed..... <i>Imports originating in the United States and Porto Rico</i> Hungarian leather and other prepared hides and skins not specified, not dyed..... <i>Imports originating in the United States and Porto Rico</i>	<i>Per 100 pounds.</i> 50 p. ct. 40 p. ct. 16.63 7.88 6.48 6.57 6.25	<i>Per 100 pounds.</i> 35 p. ct. 25 p. ct. 10.94 5.28 3.50
477	Artificial leather, common, or leather board: Unworked..... Worked (soles, heels, stiffeners, and similar articles, complete or in cut parts, etc.).....	2.63 3.50	1.75 2.19
477bis	Artificial leather with balata, india rubber, or similar base.....	9.19	6.12

¹ Patent leather, when mineral tanned, except with a substance having a base exclusively of alum, is subject to one-half the surtax imposed on that process, according to the kind of hide or skin.

ORIGIN OF LEATHER IMPORTS.

The source of the imports of leathers is indicated by the following table, giving the quantity imported from the principal countries:

Articles and countries.	Pounds.	Articles and countries.	Pounds.
Goat, sheep, and lamb skins, tanned or tawed only:		Goat, kid, sheep, and lamb skins, prepared by mineral tannage:	
Spain.....	751,080	Germany.....	121,660
Turkey.....	28,380	United Kingdom.....	67,100
United Kingdom.....	1,506,120	United States.....	343,860
All other countries.....	133,100	All other countries.....	12,100
Total.....	2,418,680	Total.....	544,720
Other skins, tanned or tawed only:		Other skins prepared by mineral tannage:	
Belgium.....	2,147,420	Austria-Hungary.....	141,460
Germany.....	1,408,220	Germany.....	488,960
United Kingdom.....	5,853,100	United Kingdom.....	109,560
United States.....	107,360	United States.....	51,480
All other countries.....	494,560	All other countries.....	32,780
Total.....	10,010,660	Total.....	834,240
Calfskins, finished or ready to finish, tawed or prepared by vegetable tannage:		Varnished or japanned leather:	
Germany.....	156,420	Belgium.....	85,140
United Kingdom.....	71,280	Germany.....	480,260
All other countries.....	54,120	United Kingdom.....	100,760
Total.....	281,820	United States.....	47,900
Goat, kid, sheep, lamb, calf skins, etc., of natural color, dyed, or black:		All other countries.....	6,390
Belgium.....	33,660	Total.....	720,500
Germany.....	333,080	Leather, prepared and finished, net otherwise specified:	
United Kingdom.....	172,260	Belgium.....	261,140
United States.....	89,760	Germany.....	230,440
All other countries.....	72,160	United Kingdom.....	423,500
Total.....	701,020	All other countries.....	34,760
Cow and other large hides:		Total.....	939,840
Austria-Hungary.....	74,140	Leather belting:	
Belgium.....	106,700	Belgium.....	290,640
Germany.....	165,660	Germany.....	66,000
United Kingdom.....	526,020	Switzerland.....	14,960
All other countries.....	32,560	United Kingdom.....	139,480
Total.....	905,080	United States.....	7,920
		All other countries.....	8,590
		Total.....	536,590

CHARACTER OF LEATHERS IN DEMAND.

The leathers desired by the French market include hemlock sole leather, especially in the cheaper grades; rough splits; waxed splits; box calf, black and colored; glazed kid, black and colored; patent kid; patent sides; white washable chrome leather, in sides and in skins; carriage leathers; harness and bag leathers.

As a rule, the French market requires chiefly the better grades, but there are exceptions, as, for instance, hemlock sole leather, the cheaper lines of which would find a ready sale but for tariff disadvantages.

The leather trade in this country is gradually being concentrated in districts, although not to the same extent as in Great Britain. The principal leather districts are Paris, Nancy, Fougères, Limoges, Romans, Lyon, Toulouse, and Bordeaux.

The special demands of the various localities mentioned (the more important shoe-manufacturing districts) may be stated as follows: Paris uses chiefly the better grades of upper leathers, but there is a certain sale for the commoner grades, including those at 12 cents per foot and better grades up to 45 cents. Nancy uses medium-priced and common grades, at prices ranging from 10 to 35 cents per foot. Fougères uses mostly the cheaper grades, ranging in price from 5 to 30 cents per foot. Limoges, Lyon, and Toulouse use the fairly good and better grades of upper stocks, paying 12 to 45 cents per foot. Bordeaux uses some of the very best grades and pays from 16 up to 59 cents per foot.

German and English tanned leathers, together with those of domestic manufacture, compete with the American on the French market. Prices of the latter are naturally higher on most lines, owing to the higher customs duty. In some instances the prices of American leathers compare favorably with competing lines, but only because few such goods are produced in other countries; moreover, these lines represent only a small percentage of the total amount of leather consumed.

It is stated by those having an intimate knowledge of the leather trade in this country that at the same price, provided deliveries were guaranteed to arrive equal to sample, preference would be given to American upper leathers.

I am assured that if American leathers could be entered at the same rate of duty granted to German and English leathers, the prospects for American leather trade with France would be excellent, and that American tanners would then have in France one of the best markets in Europe. Care would also have to be taken in selection and terms. Drawing on the buyers, bills to be accepted after the goods have been checked and found up to sample submitted, would prove most satisfactory.

If equal tariff conditions existed American tanners would doubtless find it to their advantage to open branch houses in Paris, with sales offices in the different leather districts, as has been done in Great Britain. Deliveries for this market must be made punctually on the dates specified when sale is effected, and the goods must be strictly up to sample. In the latter respect the French manufacturers are especially particular. Buyers in this country are unwilling to accept one delivery perhaps superior to sample, and the next

24 SHOE AND LEATHER TRADE IN FRANCE AND SWITZERLAND.

delivery inferior, the one to balance the other. They insist upon uniformity, each delivery to be strictly equal to the sample from which lots were selected.

BOOT AND SHOE TRADE.

The present American boot and shoe trade with France is gratifying. According to the United States Bureau of Statistics, exports of boots and shoes to France have been as follows:

Fiscal year ended June 30—	Pairs.	Value.	Fiscal year ended June 30—	Pairs.	Value.
1903.....	45,099	\$109,874	1908.....	73,664	\$238,702
1904.....	30,817	87,553	1909.....	102,431	340,324
1905.....	21,392	64,722	1910.....	141,594	425,081
1906.....	40,220	126,239	1911.....	111,306	362,904
1907.....	87,697	262,485			

American footwear has become popular to a marked degree. In Paris especially the trade is cosmopolitan in character and has a broad clientele, yet includes all classes of French people. Outside of Paris American footwear finds sale more largely among the well-to-do classes.

REQUIREMENTS OF FRENCH TRADE.

The French customer demands the most advanced fashion in every respect, and almost invariably light-weight lines. The Louis XV heel so generally worn by French women five years ago has been largely supplanted by the Cuban heel. Louis XV heels are still used on house and evening shoes for women, but it is stated that requests for street shoes with French heels are about one-tenth of what they were five years ago. The long straight French "forme" has also been to a large extent displaced by the typical American last. Elegance and comfort, combined with style and finish, and variety in shape and shade are characteristic requirements of the trade.

The present season is largely given over to colors and fancy combinations for both men's and women's footwear. Colored cloth or gaiter tops, with vamp of self, or darker toned, or black or white leather, and black and white gaiter tops with black patent vamp are combinations frequently seen. Boots of this character are worn, as previously stated, by both men and women, and for ordinary street wear, the combination often carrying out in the gaiter top the color of trousers or costume.

Sizes and widths desired are practically the same as in the United States, with a larger proportion of small sizes (1½ and 2) for women.

SOURCE OF IMPORTS.

Imports of boots and shoes into France in 1910 were valued at \$3,346,108. The following table shows the quantity imported from various countries:

Countries.	Pairs.	Countries.	Pairs.
Austria-Hungary.....	20,096	United Kingdom.....	660,099
Belgium.....	64,476	United States.....	115,141
Germany.....	88,295	All other countries.....	22,365
Italy.....	6,693		
Spain.....	29,068	Total.....	1,155,599
Switzerland.....	149,667		

CUSTOMS DUTIES.

The fact that the United States does not enjoy the minimum tariff on boots and shoes entering France, which rates are granted to competing countries, constitutes a handicap to the rapid increase of American trade. The following table gives the general and minimum rates on boots and shoes. Rates other than the general rates that are applicable to American products are in italics.

Tariff No.	Articles.	General tariff.	Minimum tariff.
	Manufactures of hides and skins, and leather, natural or artificial:	<i>Per 100 pounds.</i>	<i>Per 100 pounds.</i>
478	Straps for clogs, soles cut out of beaten and sleeked leather, heels, stiffeners, and the like, complete or in cut parts, of natural leather.	\$7.00	\$4.38
479	Boot and shoe uppers, gaiters, leggings, vamps, insteps (shaped or not), and quarters, of calf, cow, horse, goat, or kid leather— Of other than patent leather.	16.63	10.94
	<i>Imports originating in the United States and Porto Rico.</i>	15.32	
	Of patent leather.	23.20	15.32
480	Top boots (bottes)— With leather soles, nailed, or wooden soles.	<i>Per pair.</i> .58	<i>Per pair.</i> .39
	<i>Imports originating in the United States and Porto Rico.</i>	.48	
	With leather soles sewed on.	.96	1.58
481	High shoes— Woolen, cotton, or hemp, with leather soles.	.29	.19
	Woolen, cotton, or hemp, with fittings of leather, of sheepskin, black goatskin, or flesh split of cowhide.	.48	.29
	Of dyed goatskin, kid or imitation thereof, morocco, colt skin, of tawed, waxed, natural, patent leather or glazed calfskin, of any other leather not specified, or of silk or silk mixed with other materials.	.58	.39
482	Low shoes— Woolen, cotton, or hemp, without fancy fittings or embroidery, with leather soles.	.14	.096
	Woolen, cotton, or hemp, with fancy fittings; of sheepskin, black goatskin, or flesh split of cowhide.	.24	.14
	Of dyed goatskin, kid or imitation thereof, morocco, colt skin, of tawed, waxed, natural, or patent leather, glazed calfskin, of any other leather not specified, or of silk or silk mixed with other materials.	.29	.19
	Shoes reaching to the ankle: <i>Dutiable as low shoes, of the corresponding kind, plus.</i>	.077	.048
483	Children's footwear, with leather soles less than 17 cm. in length— Wholly or partly of leather, or of pure silk, or silk mixed with other materials, sewed.	.14	.096
	Other.	.048	.029

¹ Applies to imports originating in the United States and Porto Rico.

The higher cost of production in the United States, the greater distance from the French consumer, and the tariff necessarily place American footwear at a cost disadvantage as compared with that of competing foreign manufacturers. Further, the American manufacturer must reckon with what I am told may be considered an unprecedented development and improvement in the domestic boot and shoe factories, especially during the past two years.

RANGE OF PRICES—FEWER IMITATION AMERICAN GOODS.

Both French and English boots and shoes as at present manufactured are copies, and in some instances most excellent copies, of the genuine American-made product; consequently buyers of more limited means satisfy their needs with the lower priced article.

Women's American shoes are retailed generally in France at 21 to 40 francs (\$4.05 to \$7.72) per pair, with special lines as high as 45 francs (\$8.69) per pair. Men's shoes are sold at 25 to 40 francs (\$4.83

to \$7.72) per pair; little gents', or youths', at 21 francs (\$4.05); children's, sizes 11½ to 2, at 15.50 to 18.70 francs (\$3 to \$3.61).

British-made shoes are sold in France at various prices from 11.95 to 32 francs (\$2.30 to \$6.18) per pair for women's lines, and 16.50 to 35 francs (\$3.18 to \$6.76) for men's goods.

Imports from Germany are principally in the cheaper grades, while those from Austria-Hungary are mostly handmade house and evening shoes.

I find a marked change in certain aspects of the retail shoe trade in Europe since my former trade investigations in 1906. At that time the genuine American-made shoe was far less common on the market than now, and imitations purporting to be American articles were very frequently shown. This attempt to secure business on the reputation of the American shoe has evidently been discontinued, at least it is not now carried on so generally.

The foreign-made shoe is unmistakably improved in every respect, and fortified by the certain knowledge of this improvement foreign manufacturers and retailers of high-grade goods exhibit and advertise their products on their own merits.

The prices at which women's French-made shoes of classes and qualities competing with American are sold range from 11.25 to 42 francs (\$2.17 to \$8.11) per pair. Men's goods of corresponding grades are sold at 16.50 to 40 francs (\$3.18 to \$7.72).

As regards the extension of American shoe trade with France, the situation in this, as in other countries previously reported upon, demands properly directed sales methods, preferably an American retail shoe store personally maintained and directly managed, numerous examples of which already exist in Great Britain and on the Continent. The business of these houses is reported as being satisfactory and constantly increasing. Second in value would be placing the goods on the market through an agency, exclusive, of course, since any agent handling several foreign lines, or goods of his own and foreign lines, is naturally inclined to push the one yielding the larger profit.

The French market is well worth the personal study of any boot and shoe manufacturer who intends entering upon export trade.

SWITZERLAND.

BOOT AND SHOE MANUFACTURING.

Switzerland has between 30 and 40 factories in which boots and shoes are manufactured by machinery. Kreuzlingen and Geneva have four factories each, and Herzogenbuchsee, Olten, Pruntrut, Winterthur, and Aarau two each; the remainder are scattered, one factory to a town, throughout the country.

The most important firm is C. F. Bally (Ltd.), established in 1851, and owning and operating nine factories. The firm manufactures chiefly for a widely distributed export trade, which includes continental Europe, Great Britain, Africa, and South America. It employs in its various factories at present 4,062 persons, of whom 2,028 are males and 2,034 females. In addition, 481 persons are employed as home workers. The principal factory is at Schoenenwerd, about 34 miles from Zurich, in which are employed 2,595 persons. The location of other factories of the firm and the number of employees are as follows: Aarau, 390; Dottikon, 378; Schoeftland, 219; Dranicken, 193; Reitnau, 110; Kulm, 102; Kirchleerau, 61; Nieder-Gosgen, 14.

BALLY FACTORY BUILDINGS.

All the Bally factories are of the most modern construction, built of stone or concrete, well lighted, and with special attention to sanitation. Admirable systems for ventilation and dust collection are installed throughout. There are modern lavatories in every factory, and in the larger factories bathrooms for the use of the operatives. The charge for a hot bath is 30 centimes (6 cents), and for a hot or cold shower 10 centimes (2 cents).

Each factory is also provided with spacious, well-heated, and well-ventilated dressing rooms. A special room is reserved in all the factories for employees who may meet with accident or become ill, and a trained nurse is constantly in attendance. Large dining rooms are set apart in each factory where dinners are provided and served by the company at the fixed prices of 30 and 70 centimes (6 and 14 cents). The lower priced meal includes, for example, rice soup, boiled beef with potatoes, and bread, and is furnished at a loss to the company of about 4 cents per meal per person. All employees who desire it are served a glass of hot milk at 9 o'clock every morning, for which a charge of 45 centimes (9 cents) per week is made.

Most of the Bally factory buildings are surrounded by attractively designed gardens, while the Schoenenwerd factory adjoins a large park belonging to the firm and open to all. The company also has at Schoenenwerd a large recreation building, in which conferences, concerts, and theatricals are held. Many of the employees occupy houses belonging to the firm, which are rented at liberal rates, while the company advances money at a low rate of interest to those who wish to buy homes.

WELFARE WORK—LACK OF SPECIALIZATION.

Every unmarried man and woman employed at Bally's is obliged to deposit at least 5 per cent of his or her wages in the Canton, or State, savings bank, which sums may be withdrawn only upon marriage or other specified special circumstances. I am informed that many save voluntarily more than the 5 per cent and that the savings of the Bally employees last year aggregated 241,010 francs (\$46,515).

Every man and woman employed may become a member of one of the sick funds that are maintained. There are three classes of members in these, the first class paying 12 cents, the second class 22 cents, and the third class 32 cents per month. Every member when ill is entitled to the services of a physician and to medicine free of charge; in addition female members of the second class receive 24 cents and male members 30 cents per day, while members of the third class receive 50 cents per day in addition to a physician's services and medicine. Serious cases of illness demanding hospital treatment or an operation are also provided for at the expense of the fund.

There is also an old-age pension system, the object of which is that the employee, with the help of the company, may accumulate, by yearly payments to a savings bank, such a sum that at 65 years of age he may retire and buy, should he so desire, a life rent, or lease, of a house belonging to the firm for his occupancy. The company contributes from 25 to 62½ per cent of the yearly installments to the old-age pension fund, the amount being determined by the years of service of the employee. Instead of yearly payments to the savings bank, a portion of the amounts may, if preferred, be used for endowment life insurance payable on the attainment of the sixtieth year.

All of Bally's factories are fully equipped with shoemaking machinery, much of which is American; the remainder is German and French. The motive power is electricity. The company endeavors, as far as possible, to specialize the work in its various establishments, but specialization like that found in the United States is out of the question in this country, which, with its 3,750,000 inhabitants, is too small to permit the adoption of American methods. An up-to-date factory here must be able to fill all demands, to supply boots and shoes for infants, children, misses, youths, women, and men. A majority of the shoe dealers in Switzerland stock Bally's goods, and in every locality each dealer wishes to handle lines other than those sold by his neighbor, consequently the manufacture of more kinds and classes is necessary. Furthermore, the large export trade of the firm is distributed among countries of widely differing demands, and extensive specialization is as impossible in the foreign as in the home department.

ACCESSORY DEPARTMENTS—OUTPUT.

Sole and upper cutting are done exclusively in the Schoenenwerd factory, while stitching is done in five and bottoming in six factories. The factories are provided with the following accessory departments: A wooden-heel factory, with an output of about 4,000 pairs of wooden heels daily; a factory where wooden heels are covered with leather, canvas, or celluloid; a factory for inks, blackings, stains, and cements;

a last factory; an elastic-web factory; other departments include the manufacture of standard screw wire, cardboard fillers, shoe patterns, counters, box toes, and shoe cartons. There are also a large machine shop in which certain machines are made and repairing is done, a die shop, and a joiners' shop where wooden articles such as shoe racks are made. There is also a special department for hammering sole leather.

The combined production of the Bally factories is 11,000 pairs per day, as follows: 1,000 pairs infants' turned and nailed, 1,800 pairs girls' McKay sewn and screwed, 4,000 pairs women's McKay sewn and screwed, 2,000 pairs women's turned, 1,200 pairs women's and men's Goodyear welted, 1,000 pairs men's McKay sewn and screwed. The total weekly production of the entire industry in Switzerland at present is 138,600 pairs, including 4,200 pairs of wooden shoes. A list of the Swiss firms, with addresses and statement as to the nature and quantity of output, is given on pages 43 and 44.

STATUS OF INDUSTRY—CHARACTER OF OUTPUT.

The boot and shoe industry in Switzerland has apparently grown but little in recent years; in fact, during the past few years business has fallen off, owing, it is stated, to overproduction. I am told, however, that a new factory, with a daily capacity of 500 pairs, is to be built during the present year by a company known as the Cooperative Society of Switzerland. McKay-sewn, Standard-screwed, and pegged goods will constitute the output, which will be distributed through the cooperative stores of the society maintained in many of the larger Swiss towns. Hitherto this society has imported largely from European countries the footwear it now proposes to manufacture.

Only the more recently constructed factories in Switzerland may be called modern, but most of them are very well equipped with machinery, though all of the latter is not of the latest type. The more progressive manufacturers are ready to adopt up-to-date systems and to install the latest equipment, while others, the majority perhaps, are still conservative as regards undertaking the manufacture of better-grade work. German machinery is the principal competitor of American equipment; France also supplies a certain amount of machinery, principally that made by Johnson & Fils, Paris. The United Shoe Machinery Co., of Boston, maintains an office in Zurich, where a large supply of spare parts, etc., is kept on hand; the Atlas Werke (German) also has an office in the same city. Other competing machinery firms carry on business through agents who make periodical visits to the trade.

McKay-sewn goods forms the bulk of the Swiss boot and shoe production; nailed and pegged, welted, and turned work follow, in the order named. A beautiful turned shoe for women is made at the Bally factories, largely for export trade; Swiss-made McKay-sewn goods in general are very fair, but welted work is not so well understood and is apt to run poor. Goods for the export trade are made as nearly like an American article in appearance as possible, American-shaped lasts being used and all details of finish closely copied. While the tendency for the home trade is toward the American shape, there is possibly a preference for a somewhat modified American shape, a style between the American and the French.

The Swiss manufacturer uses a good grade of leather in his various products, considering the price. The domestic trade for which he largely caters demands a strong article, none other being able to withstand the hard usage of the rough and hilly country. Certain circumstances and conditions peculiar to the country tend to increase the cost of both labor and materials, first of which is the impossibility, from the point of view of the Swiss manufacturer, of specializing. Second, owing to the lack of sufficient efficient workpeople, the industry can not be concentrated in a center or in centers, as in most countries. The Bally company, for instance, manufactures in nine factories, located of necessity in as many towns. Great difficulty is experienced, particularly during the summer months, in procuring a sufficient number of female operatives, service in hotels, with higher wages, including tourists' fees, being preferred to factory work. Third, the Swiss industry is dependent upon foreign countries, not only for factory equipment but also for most of the materials used; consequently larger stocks of upper and bottom leathers than would otherwise be necessary must be kept on hand, at a loss of interest on capital. The cost of production is furthermore increased through the operation of the Swiss employers' liability law, the employer being liable under this act for every accident occurring in his factory, and being compelled to insure the risk at a high premium or at times pay heavy indemnities.

WAGE SCALES.

The daily or weekly system of wage payment prevails; the average wages for the various operations are given in the following:

CUTTING AND STITCHING ROOM.

Operations.	Weekly wages.	Operations.	Weekly wages.
Pattern designing.....	\$15.44	Crimping on Lockett machine.....	\$5.31
Pattern grading on Hartford machine.....	3.72	Skiving.....	4.63
Pattern cutting on pattern shears.....	3.72	Folding, by hand.....	4.24
Pattern binding.....	3.72	Perforating on Royal machine.....	3.86
Lining cutting on revolution press.....	4.78	Pasting in middle linings on hub-lining	
Lining pricking on Boston machine.....	2.34	cement.....	4.24
Lining marking, by hand.....	3.72	Seam rubbing.....	3.18
Cutting outsides.....	6.37	Beading tops, by hand.....	3.18
Cutting trimmings, etc., by hand.....	4.46	Hooking on, by hand.....	3.72
Stamping upper leather on power machine.....	4.25	Eyebetting on Duplex.....	4.24
Blucher-vamp marking.....	4.25	Lacing on Ensign lacer.....	3.86
		Closing.....	5.21

SOLE-LEATHER ROOM.

Dieing out:		Cutting rands from strips with Universal machine.....	\$4.78
Soles.....	\$6.37	Cutting rands from counter offal with	
Insoles.....	6.37	Scott machine.....	3.18
Counters and box toes.....	6.37	Counter nicking.....	5.31
Side linings, tar felt, and shank		Counter rolling.....	5.31
pieces.....	4.78	Counter molding.....	5.31
Lifts.....	4.78	Building heels with clinch machine.....	4.24
Pieced lifts.....	4.78	Compressing heels with No. 4 press.....	4.78
Evening, by machine.....	4.45	Condensing top lifts.....	4.78
Marking (numbering) soles, insoles, and			
counters.....	3.47		
Tacking rands on lifts with power welt			
tacker.....	4.63		

McKAY-SEWN AND PEGGED WORK.

Operations.	Weekly wages.	Operations.	Weekly wages.
Sorting lasts.....	\$4.56	Heel scouring.....	\$5.79
Tacking on insoles with staple tacker.....	3.40	Heel-breast scouring.....	3.40
Sorting uppers and laying them with lasts.....	3.18	Jointing shank and heel, by hand.....	4.78
Pasting counters and box toes.....	3.18	Edge blacking.....	3.97
Assembling.....	3.18	Edge setting:	
Pulling over, by machine.....	5.84	Without stitch wheeling.....	5.02
Lasting on Consolidated (complete).....	6.95	With stitch wheeling.....	5.79
Pulling insole staples.....	3.18	Bottom and top lift scouring.....	3.40
Pounding with rotary pounding-up machine.....	4.78	Bottom and top lift buffing (cleaning).....	3.40
Tacking on soles and nailing heel seats with taper nail tacker.....	5.40	Blacking heels and bottom, by hand.....	3.72
Heel-seat trimming.....	5.84	Polishing heels and beading edge with Xpedite.....	4.56
Pounding heel seats and drawing lasts.....	5.02	Coloring and brushing forepart.....	3.72
Sewing with Rapid McKay sewer.....	6.37	Blacking and polishing shank.....	3.72
Pegging with Davey machine.....	6.37	Coloring and brushing pegged bottoms with oakalline.....	3.47
Channel cementing, by hand.....	3.18	Top ironing.....	4.44
Channel closing.....	3.86	Ornamenting shanks.....	5.21
Leveling with Hercules or Cyclops lever.....	5.31	Laying sock lining.....	3.86
Randing and edge trimming.....	5.40	Rubbing up bottoms, cleaning slugs, and drawing lasts.....	4.25
For edges without stitch wheeling.....	5.02	Cleaning upper leather, by hand.....	4.25
Attaching heels with Lightning machine.....	6.37	Stamping trade-mark on soles with Regent.....	4.25
Slugging.....	6.90	Cleaning uppers and linings, treeing, dressing, lacing or buttoning, and packing.....	4.44
Heel trimming.....	5.84		
Heel breasting.....	5.31		
Fetching finishing lasts and relasting.....	5.21		

GOODYEAR-WELTED WORK.

Sorting lasts.....	\$4.56	Leveling.....	\$5.31
Tacking on insole with taper tacker.....	3.40	Heel-seat nailing with loose nailer or Davey machine.....	6.37
Tacking on reinforcing piece at heel and trimming heel seat.....	3.18	Heel-seat trimming.....	5.84
Sorting uppers and laying them with lasts.....	3.18	Scouring shank and heel seat before heeling.....	3.72
Pasting counters and box toes.....	3.18	Edge trimming in pairs.....	5.84
Assembling, by machine.....	3.18	Attaching heels with Lightning machine.....	6.37
Pulling over, by machine.....	5.84	Slugging.....	6.90
Pulling up lining and tacking sides of heel seats.....	4.78	Heel trimming.....	5.84
Lasting heel seats and sides, on Consolidated.....	7.72	Heel breasting.....	5.31
Lasting toes on No. 5 bed machine.....	7.72	Heel scouring:	
Trimming upper leather on Rex machine.....	6.37	Coarse.....	5.21
Pounding heel seat and tapping up toe on rotary machine.....	4.78	Fine.....	6.95
Pulling lasting tacks, removing toe wire, and resetting tacks to hold upper before welting, by hand.....	4.78	Heel breast scouring.....	3.40
Inseaming with model K machine.....	5.31	Jointing shank and heel, by hand.....	4.78
Pulling insole staples and tacks holding upper.....	5.31	Gumming and twice blacking edge.....	2.97
Skiving ends of welts and fastening with small tacks, welt sewing, and welt beating (done by one operator).....	7.72	Edge setting.....	6.37
Filling bottoms.....	5.31	Stitch burnishing with Booth machine.....	6.37
Tacking in shank piece.....	3.18	Top-lift sanding.....	3.40
Cementing bottoms.....	5.31	Bottom scouring, forepart.....	3.40
Sole laying.....	5.31	Bottom and top lift (cleaning).....	3.40
Sole rounding and channeling, channel opening, and stitching with model M machine (done by one operator).....	7.72	Blacking heels and bottoms twice, by hand.....	3.72
Channel cementing.....	3.86	Coloring and brushing forepart.....	3.72
Channel closing.....	3.86	Blacking and polishing shank.....	3.72
Stitch wheeling with Goodyear indenting and burnishing machine.....	6.37	Rubbing up bottoms and cleaning slugs.....	3.72
		Drawing lasts.....	5.31
		Stamping trade-mark on heels with Regent.....	4.25
		Laying heel-seat sock lining and examining inside of shoe for tacks.....	3.86
		Cleaning upper leather with machine.....	4.25
		Cleaning lining.....	3.47
		Ironing upper with Miller machine.....	4.25
		Lacing or buttoning.....	4.44
		Packing.....	4.44

WORK DONE BY WOMEN, GIRLS, AND BOYS.

Tacking on, reenforcing piece at heel, and trimming heel seat are done by women; skiving, folding, crimping, and marking, by women and girls; channel cementing, channel closing, heel-breast scouring, bottom and top lift scouring and buffing, coloring and brushing forepart, blacking and polishing shank, tacking on insole with staple tacker, scouring shank and heel seat before heeling, gumming and twice blacking edges, and stamping trade-mark on soles, by girls; edge blacking, by girls or boys; assembling and pulling insole staples, by boys.

ACTUAL COST OF GOODYEAR AND M'KAY WORK.

The following are the actual daily wages paid in one factory for various operations on the best grades of Goodyear-welting and McKay-sewn goods manufactured in Switzerland:

Operations.	Men's boots and shoes.	Women's boots and shoes.	Operations.	Men's boots and shoes.	Women's boots and shoes.
GOODYEAR-WELTED WORK.			M'KAY-SEWN WORK.		
Pulling over by machine..	\$1.06-\$1.35	\$1.06-\$1.15	Pulling over by machine..	\$1.35-\$1.44	\$1.37-\$1.43
Lasting:			Lasting on Consolidated..	1.46-1.57	1.53-1.78
On Consolidated.....	1.64-1.79	1.16-1.41	Sewing.....	1.16	1.15-1.56
On No. 5 bed machine..	1.13-1.25	1.22-1.43	Leveling.....	1.48-1.55	1.36-1.61
Welting.....	1.38	1.31-1.39	Heeling.....	1.24	1.12-1.25
Rough rounding.....	1.37-1.43	1.27-1.30	Heel trimming.....	1.38	1.48-1.78
Stitching.....	1.12-1.22	1.30-1.35	Edge trimming.....	1.18	1.13-1.45
Leveling.....	1.32-1.64	1.34-1.43	Edge setting.....	1.56-1.64	1.19-1.70
Heeling.....	1.27-1.36	1.06-1.22			
Heel trimming.....	1.56	1.54			
Edge trimming.....	1.33-1.38	1.28-1.31			
Edge setting.....	1.43-1.60	1.55-1.75			

In the sole-leather room, sole cutters are paid \$1.09 to \$1.31 per day and heel builders \$0.75 to \$0.83. In the cutting room, cutters are paid \$1 to \$1.24. Various other operations are paid for as follows: Closing, \$0.69 to \$1.04; eyeleting, \$0.78; hook setting, \$1.02; packing in cartons, \$0.62 to \$0.77.

TANNING INDUSTRY AND LEATHER TRADE.

Comparatively little of either sole or upper leather is tanned in Switzerland. Two sole-leather and one upper-leather tannery may be mentioned, they being the only important establishments. Staub & Co., Mannedorf, sole-leather tanners, work about 300 sides daily, and Gerberei Olton, A. G., Olton, tan about 600 sides daily. Both are equipped with modern machinery, and a good quality of sole leather is produced. The products of the Gerberei Olton especially (hemlock extract tannage) enter into keen competition with hemlock sole leather imported from the United States. Swiss-tanned hides are well worked in the bellies and fully cleaned on the flesh side, and a leather of excellent appearance is the result. The combination tannage system requiring from four to six months is usually employed, although some cheaper-grade sole leather is produced by the quick-tannage system.

The only upper leather tannery of importance in Switzerland is located at Aaburg, operating under the firm name of A. Hagnauer & Co. The production is calf leather tanned by both the vegetable and the chrome tanning processes, and the firm employs about 100 hands.

Wages in both sole and upper leather tanneries average about 5 francs (97 cents) per day for ordinary labor, while a skilled tanner receives from 7 to 10 francs (\$1.35 to \$1.93).

IMPORTS OF LEATHER.

As previously stated the Swiss boot and shoe industry is largely dependent upon foreign tanners for both bottom and upper leathers. The domestic sole-leather tanneries do not produce sufficient bottom leather to meet the demands. The supply of box calf is very limited, and no glazed kid, comparatively large quantities of which are cut, is manufactured in the country.

The total imports of leather into Switzerland during 1910 were valued at \$5,532,345, of which sole and upper leathers comprised \$4,583,487. The remaining \$948,858 worth was made up of harness and saddlery leathers, leathers for military equipment, uppers and soles for shoes previously prepared, etc. The source of the Swiss leather imports is shown in the following statement:

Countries.	Value.	Countries.	Value.
SOLE LEATHER.		COW AND SPLIT LEATHERS.	
Australia.....	\$20,641	Austria-Hungary.....	\$5,790
Austria-Hungary.....	250,297	France.....	10,061
Belgium.....	77,765	Germany.....	286,686
France.....	177,287	Italy.....	19,010
Germany.....	1,169,174	All other countries.....	4,661
Italy.....	9,804		
Netherlands.....	15,067	Total.....	326,198
United Kingdom.....	130,323		
United States.....	414,216	ALL OTHER LEATHERS, INCLUDING KID AND SHEEP.	
Total.....	2,264,574	Austria-Hungary.....	40,530
UPPER LEATHER, CALF.		Belgium.....	16,868
Austria-Hungary.....	2,866	France.....	31,497
France.....	75,882	Germany.....	936,411
Germany.....	216,000	United Kingdom.....	175,784
Italy.....	4,435	United States.....	433,395
United Kingdom.....	46,291	All other countries.....	4,963
United States.....	7,382		
All other countries.....	411	Total.....	1,639,448
Total.....	353,267	Grand total.....	4,583,487

PRINCIPAL GERMAN EXPORTERS.

Germany supplies by far the larger part of the entire demand of the Swiss sole and upper leather trade. Nearly all the cow and split leathers are supplied by Germany, and while the United States holds second place for all other upper leathers, including glazed kid, it furnishes less than one-half the amounts supplied by Germany.

As regards German competition in the various lines of leather, cowhides are furnished chiefly by Adler & Oppenheimer, Strassburg; Knapps & Schwander, Reutlingen; and Gebrüder Bräuchle, Metzingen.

The grades are first and medium, and range in price from 44 to 57 cents per pound. Lower grade lines are very little used.

Splits come from Adler & Oppenheimer, Strassburg; Knapps & Schwander, Reutlingen; Becker & Co., Offenbach; and A. Th. Meissner, Stadlilm. First and medium grades, both heavy and light, are supplied at prices varying from 26 to 29 cents per pound for the former, and from 30 to 31 cents for the latter.

Calf (box sides, fatted box, and box calf) comes from Adler & Oppenheimer, Strassburg; Becker & Co., Offenbach; Cornelius Heyl, Worms; and Doerr & Reinhardt, Worms. The prices paid are, for box calf 24 to 27 cents per square foot and for box sides and fatted box 19.3 to 22 cents per square foot.

Horsehides are supplied by Schmid & Co., Schorndorf; Knecht & Würtemann, Elmshorn; and Julius Kleinert, Mulheim on the Ruhr. Grained horsehide is bought at $13\frac{1}{2}$ to $14\frac{1}{2}$ cents per square foot for heavy goods, box-grained horsehide at $14\frac{1}{2}$ to 17 cents, and glazed horsehide at 17 to 19.3 cents per square foot.

Glazed kid comes chiefly from Adler & Oppenheimer, Strassburg; Cornelius Heyl and Doerr & Reinhardt, Worms; and Meyer & Co., Offenbach. It is used in qualities ranging in price from 15 to 38 cents per square foot. Goatskins run from $11\frac{1}{2}$ to 15 cents per square foot. Sheepskins are bought principally from French tanners at $3\frac{1}{2}$ to 6 cents per square foot.

CHARACTER OF LEATHER IN DEMAND—AMERICAN TRADE.

Cowhides and splits are used principally in black, with limited quantities in natural color; calf is consumed in both black and browns; horsehides are sold in black mostly, with infrequent orders for browns; glazed kid is used in black and browns, and sheepskins in black, brown, and white.

Cowhides and splits run mostly heavy and a few medium; calfskins, medium and light generally, with a few heavy; all other leathers are of medium or light substance, with a tendency to average medium because of the requirements of the hilly country.

The United States enjoys the same customs tariff rate on leathers entering Switzerland as is enjoyed by Germany. Sole leather pays \$1.40, box calf \$1.57, and wax calf \$2.10 per 100 pounds.

When asked why the trade of the Swiss boot and shoe manufacturer is so largely given to the German tanner, substantially the following reply was invariably given by Swiss buyers:

European tanners, especially the Germans, adapt themselves entirely to the wishes of their Swiss customers, and they supply, as a rule, a stricter selection than the American tanner. German sole leather is cleaner on the flesh side and well worked in the offal; it is also firmer than the American product and the hides have less imperfections, such as brands, cuts, and scratches. The German splits, although a little higher in price, are preferred to the American because the German splits are more supple; German upper leather, too, has a softer feel than the American, and is liked for this reason.

The foregoing is from the point of view of German-Swiss manufacturers, and a certain allowance should be made, of course, for neighborly preference. Nevertheless, it is true that European tanners are more careful in selecting lots and more painstaking in many minor details than the American tanner. Proximity is of course in Germany's favor, likewise the long credits that German exporters

grant. Importers state that on an average two to three weeks is required for delivery of orders from Germany, as against five to six weeks from the United States. German terms are arranged to meet the customers' desires, from 2 per cent 30 days cash, net 90 days, up to 6 and even 8 months' credit, if needed. German tanners invite Swiss boot and shoe manufacturers to make their own selections at the tanneries, and in some instances, at least, even pay the railroad fare thither.

LESSENING DEMAND FOR SPLITS.

The trade in splits which the United States formerly held in Switzerland has almost entirely disappeared. This is due not only to the preference now shown for splits of German tannage, but also to the fact that Swiss trade in this special line is decreasing, having fallen off greatly during the past two or three years. The country people, who constitute the principal customers for split-leather footwear, are demanding lighter goods built from cheap box side or horse box leathers. The demand for the ordinary split-leather shoe is now confined to those forced by the nature of their occupation to wear the heaviest boots and shoes. Small quantities of American cheap splits are used by clog or wooden-shoe manufacturers for clog uppers.

In spite of numerous handicaps the United States is doing a fair trade in sole leather and considerable business in upper leathers other than calf. One Swiss shoe manufacturer stated that from May 1, 1911, to April 30, 1912, the bills of the firm for freight and duty alone on leathers imported from foreign countries amounted to 261,451 francs (\$50,460). Possibly American tanners and exporters have not realized the extent of the leather market in Switzerland, and consequently have not directed their efforts toward obtaining a proportionate share of this trade.

BOOT AND SHOE TRADE.

Switzerland's exports of footwear reach nearly \$2,000,000 annually, and are increasing. The trade is widely distributed and includes practically all the various lines of goods manufactured in the country. Leather boots and shoes, the exports of which, according to official Swiss statistics, were \$1,460,673 in 1909 and \$1,497,666 in 1910, form the principal item. Provisional statistics only are available for 1911, and in these the boot and shoe exports are not stated separately.

Large quantities of fancy turned goods for house and evening wear are exported, particularly to Great Britain. The attention of American boot and shoe manufacturers and exporters is directed especially to the volume of trade done by Switzerland with certain South American Republics. During the calendar year 1910, Argentina purchased \$189,972 worth of various sorts of Swiss footwear, principally such lines of leather boots and shoes as are made in the United States. During the fiscal year 1910, the United States exported to Argentina \$283,045 worth of boots and shoes. Chile bought of Swiss-made leather boots and shoes \$78,124 worth, and of other sorts (cloth, velvet, silk, etc.), \$4,558 worth, a total of \$82,682, during 1910, while exports from the United States to Chile during the fiscal year 1910 were valued at \$30,120.

The terms of sale allowed by Swiss shoe manufacturers are in some instances 2 per cent 30 days, net 60 days; and in others 3 per cent 30 days, net 90 days.

DESTINATION OF EXPORTS.

The exports of footwear from Switzerland during 1910 are shown, by countries, in the following table:

Countries.	Value.	Countries.	Value.
LEATHER BOOTS AND SHOES.		CANVAS, LASTING, FELT, VELVET, SILK, ETC., SHOES WITH LEATHER SOLES—continued.	
Africa.....	\$12,212	Austria-Hungary.....	\$2,508
Algeria.....	891	Belgium.....	2,066
Argentina.....	140,140	Canada.....	4,076
Austria-Hungary.....	43,093	Chile.....	4,568
Belgium.....	5,069	Egypt.....	25,172
British India.....	4,374	France.....	31,862
Chile.....	78,124	Germany.....	33,530
Denmark.....	1,850	New Zealand.....	8,891
Egypt.....	154,800	Turkey.....	3,191
France.....	515,402	United Kingdom.....	146,477
Germany.....	299,634	All other countries.....	17,360
Italy.....	4,819		
Netherlands.....	618	Total.....	335,297
New Zealand.....	1,445		
Russia.....	290	ALL OTHER FOOTWEAR.	
Turkey.....	13,779	Austria-Hungary.....	375
United Kingdom.....	205,613	France.....	1,979
United States.....	95	Germany.....	141
All other countries.....	14,828	Italy.....	529
Total.....	1,497,666	Persia.....	217
		Total.....	3,381
CANVAS, LASTING, FELT, VELVET, SILK, ETC., SHOES WITH LEATHER SOLES.		Grand total.....	1,836,344
Africa.....	4,357		
Argentina.....	49,832		
Australia.....	1,876		

SOURCE OF IMPORTS.

Imports of boots and shoes into Switzerland are increasing, the total value of all boots, shoes, and slippers imported during 1910 amounting to \$2,070,608, an increase of \$294,504 over 1909. Of this increase \$239,797 was in leather boots and shoes.

As in the case of finished leather, so also in boots, shoes, and slippers, the demands of the trade are very largely met by goods of German manufacture. Imports during 1910, by countries, were as follows:

Countries.	Value.	Countries.	Value.
LEATHER BOOTS AND SHOES.		CANVAS, LASTING, FELT, VELVET, SILK, ETC., SHOES WITH LEATHER SOLES—continued.	
Austria-Hungary.....	\$86,328	United States.....	\$269
Belgium.....	15,994	All other countries.....	738
France.....	103,621		
Germany.....	1,284,441	Total.....	213,665
Italy.....	46,359		
Netherlands.....	55,306	ALL OTHER FOOTWEAR.	
Norway.....	1,230	Austria-Hungary.....	1,734
Russia.....	984	France.....	51,265
United Kingdom.....	73,440	Germany.....	63,297
United States.....	70,059	Italy.....	818
Total.....	1,737,762	United Kingdom.....	1,439
		United States.....	244
CANVAS, LASTING, FELT, VELVET, SILK, ETC., SHOES WITH LEATHER SOLES.		All other countries.....	354
Austria-Hungary.....	10,494	Total.....	119,191
France.....	34,957	Grand total.....	2,070,608
Germany.....	164,922		
United Kingdom.....	2,235		

GERMAN SHOES SOLD—AMERICAN TRADE.

Germany furnishes for this market numerous lines of footwear with which American products are unable to compete, including various grades of children's goods and cheaper grades for men and women. The cost of manufacture, including labor and materials, is so much less in Germany that American competition in the cheapest grades of footwear is out of the question. In the better grades for men and women American trade in this country is increasing, and while keen competition must be met with like grades of German and British goods produced on American lines, as well as those of domestic manufacture, which are also close copies of genuine American-made products, the outlook for further development of our trade is very favorable.

It is practically useless for American manufacturers of the cheapest lines of boots and shoes to endeavor to place them on the Swiss market. Certain quantities of the highest grades can be sold, though the demand, while increasing, is limited and will doubtless grow slowly. American goods that sell best are the medium and higher grades, at factory prices ranging from \$2.60 to \$2.75 for women's and \$2.85 to \$3.15 for men's.

Customers for American footwear in Switzerland, aside from the foreign clientele that includes visitors, residents, students, etc., are found principally among the younger Swiss folk of both sexes. With all classes, however, American-shaped boots and shoes are growing in popularity; this is true of both men and women, even the more conservative having largely abandoned the wearing of the French or other shaped styles in favor of the American. Naturally, the conservative class demands a more conservative style, the American-shaped last being liked without extreme features.

Retail dealers state that among the younger element the present season's American styles are very popular, the latest fashions in women's fancy footwear with short vamps and high Cuban heels having met with unprecedented sales.

One of the principal dealers in the country estimates that the demand for the latest American styles, both men's and women's, during the present season has been three times as great as in former years.

In the more conservative styles for men and women German competition is especially keen. The shapes of the German shoes are practically the same as the American, while they are lower in price. Children's German-made shoes, as already intimated, are preferred to the American, on account of both price and style. Swiss parents do not take kindly to children's shoes with spring heels, fearing they may cause flat foot.

RETAIL PRICES.

An average retail price in Switzerland for the better grades of German-made boots and shoes is 21 francs (\$4.05) per pair. An attempt is being made to popularize a medium-grade German shoe, which is as exact a copy of an American up-to-date product as possible, at fixed retail prices of 16.50 and 20.50 francs (\$3.18 and \$3.96) per pair for both men's and women's. Other German makes of men's boots and shoes are sold at 19 to 28 francs (\$3.67 to \$5.40). All

prices mentioned are on lines entering specially into competition with American goods.

Austrian-made footwear sold here is similar to the German products with the exception of a few turned goods. Women's Austrian-made lines are sold at 17 to 22 francs (\$3.28 to \$4.25) per pair; men's goods are priced generally at 22 to 24 francs (\$4.25 to \$4.63).

French boots and shoes of a lower grade are sold at 11.50 and 12.50 francs (\$2.22 and \$2.41) per pair for both men's and women's goods. The better grades are chiefly lighter-weight boots and shoes for women's wear, principally turned goods, which sell at 15 to 24 francs (\$2.90 to \$4.63) per pair. A very few French-made canvas shoes are also sold. It is stated that American-made canvas shoes are too heavy to suit the Swiss customer; moreover, the demand for canvas articles is quite limited.

Prices of American boots and shoes for men range from 22 to 35 francs (\$4.25 to \$6.76) per pair, with larger sales for a 25-franc (\$4.83) shoe; women's goods range from 21 to 30 francs (\$4.05 to \$5.79) per pair, with most of the trade in a 22.50-franc (\$4.34) product.

STYLES, LEATHERS, AND SIZES.

For spring, summer, and autumn wear glazed kid is the best selling leather in women's footwear; for summer particularly a larger per cent of brown is sold. For the autumn trade some patent leather is also sold, and for winter wear mostly box and chrome calf with some glazed kid and a little patent leather. Women's summer shoes are required in lighter weights than the usual American shoe. Customers are often diverted to a French shoe because of its light weight, hence women's summer goods for this trade should invariably have a light sole. The usual weight sole on American winter lines is satisfactory.

Practically the same leathers are required in men's as in women's footwear for the various seasons, with a larger percentage of calf leathers. Shoes, or oxfords, for both sexes have become very popular, and much larger quantities of them are now sold during the warm weather than of boots, or high cuts.

For the conservative trade, with whom the less extreme styles find favor, men's boots and shoes are desired in sizes 7 to 11½ and women's in sizes 3 to 8. In shapes of latest fashion men's goods are salable in sizes 5 to 10, and women's 2½ to 7. Sales of smaller sizes, 5 and 5½, in men's lines are more limited than of the medium sizes, although a considerable trade is done, particularly with Spanish, Portuguese, and other foreign students at the various Swiss schools and universities.

Some lines of American boots and shoes are bought direct from the manufacturers, others through a general European agent, and still others through commission houses. The customs duty on boots and shoes made of box calf, glazed kid, patent leather, or any other better grade leather, is 80 francs per 100 kilos (\$7 per 100 pounds), all duties being collected on gross weight. Shoe cases should be built as light as is consistent with required strength, and be well strapped to minimize opportunity of breakage for theft. As a rule shipments are in 36-pair cases for men's and 60-pair cases for women's goods.

OUTLOOK FOR AMERICAN TRADE.

In the most up-to-date styles of men's and women's boots and shoes the United States now leads all competitors in Switzerland, and it is essential that our preeminence in this particular be maintained. The European manufacturer, by close study of American methods of manufacture and by careful copying of our products, has so far improved his machine-made product that only by vigilance directed toward the special points of advantage peculiarly and preeminently possessed by the American shoe can the United States maintain and increase its export trade, not only in Switzerland, but in France and Germany as well.

At least one French and three German shoe manufacturers maintain retail stores in this country. There is at present no personally maintained American shoe store, the numerous lines of American-made goods on the market being carried by the principal Swiss shoe dealers, and one or two lines by department stores. From the point of view of the European shoe dealer, the placing of American shoes in department stores is prejudicial to the American shoe trade in Europe as a whole, and is not to be recommended. Failing the personally-maintained store, the American manufacturer should send his most advanced styles to this country through personal agents. Great care should be taken to fill all orders with goods up to sample. The American dealer may discount the sample, the Swiss dealer is not so accustomed. Realizing the niceties of trade demands, our competitors are exercising extreme care in every minor detail of finish. The American consumer may not object to cutting off a thread or a loose end from a shoe, but the European customer does object.

I wish emphatically to urge the desirability of having every pair of American boots and shoes for export trade plainly stamped "Made in the United States of America." Although the sale of other than genuine American-made footwear under American style names, with misleading labels on the cartons, the country of origin not being stated but the contents purporting to be of American manufacture, is not done so frequently and so openly as formerly in European countries where genuine American-made shoes have now become well known, it is still done in some instances. I am told that certain lines so designated are exported to various countries, where they doubtless find sale as American goods. Swiss retail dealers state that it is now difficult to sell an American shoe other than those with well-known trade-marks, unless the maker's name and place of manufacture is woven on the strap or facing, or is plainly stamped on the sole.

[Accompanying Mr. Butman's report on Switzerland were five pairs of shoes and seven excellent photographs of the Bally factories, all of which will be loaned to interested firms upon application to the Bureau of Manufactures.]

APPENDIX.

FRENCH BOOT AND SHOE MANUFACTURERS.

NOTE.—Fair-stitched work is known as mixed in France.

Names and addresses of firms.	Daily production.	Class of work.
PARIS.		
Behr & Iung.....	<i>Pairs.</i> 500	Goodyear, McKay, and mixed.
A. Bloch.....	125	Goodyear and McKay.
Bolsselier Fils.....	200	Do.
Bulard.....	250	Goodyear, McKay, and mixed.
Chapelier.....	150	McKay and nailed.
E. Chapuzot.....	250	McKay and slippers.
Collard.....	400	McKay and mixed.
Delatour.....	1,000	Slippers.
Derreal Père & Fils.....	250	Goodyear and McKay.
Dressoir, Pémartin & Pulm.....	1,500	Goodyear, McKay, and mixed.
Ehrlich Frères.....	300	Do.
P. Gregoire.....	600	McKay and mixed.
Hamelin.....	400	Goodyear, McKay, and slippers.
Hattat.....	400	Goodyear and McKay.
E. Lamy & Fils.....	150	Goodyear, McKay, and mixed.
Martin & Picard.....	300	Slippers and McKay.
Massot & Negre.....	150	McKay and mixed.
G. Mayer & Co.....	125	Goodyear, McKay, and mixed.
Monteux & Co.....	700	Goodyear.
Ple Frères.....	600	Goodyear, McKay, and mixed.
Samie.....	300	McKay and mixed.
Sté. des Fournitures Militaires.....	200	Goodyear and McKay.
NANCY.		
Claude & Durupt.....	200	McKay and mixed.
Gustave Collas.....	150	Do.
A. Discours & Fils.....	150	Do.
Vve. Doerflinger.....	150	Do.
René Geny.....	300	Goodyear, McKay, and mixed.
Vve. Laurent & Fils.....	500	McKay and mixed.
J. Leprettre.....	100	Do.
A. Leroy.....	1,500	Goodyear, McKay, and mixed.
A. & J. Levy.....	2,000	McKay and slippers.
Martin & Picard.....	1,500	Goodyear, McKay, mixed, and slippers.
Neubecker.....	150	McKay and mixed.
Antoine Ney.....	100	Do.
L. Odenat.....	300	Goodyear, McKay, and mixed.
Paulus, Lamotte & Bertrand.....	150	McKay, mixed, and nailed.
A. & P. Pernot.....	500	Goodyear, McKay, and mixed.
P. Spire.....	1,200	Goodyear, McKay, mixed, and slippers.
ROMANS.		
Bonnefoy.....	600	Goodyear, McKay, mixed, and nailed.
Bonnefont Jourdan.....	100	McKay and mixed.
Eisenreich & Co.....	200	McKay and nailed.
J. Fenestrier.....	500	Goodyear.
Figuet & Co.....	300	Goodyear, McKay, and mixed.
E. Granger & Fils.....	250	Do.
Ph. Grenier Fils.....	300	Do.
Juven & Co.....	150	Goodyear and mixed.
Robin.....	100	McKay.
Rosset & Co.....	200	Goodyear and mixed.
P. Roux.....	150	Goodyear, mixed, and McKay
St. Cyr Cheval.....	200	Do.
L. Turpin.....	150	Mixed and nailed.
LIMOGES.		
Marcelin Bancaud.....	100	McKay.
Paul Denis.....	250	Goodyear, McKay, and mixed.
Dutour Fils.....	200	Goodyear and McKay.
A. Fougeras & Co.....	400	Goodyear.
Monteux & Co.....	1,800	Goodyear, McKay, and mixed.
Pericaud Lionet & Co.....	200	Goodyear and McKay.
Talnaud Bancaud & Co.....	200	Do.
L. Trapinaud & Co.....	300	Do.
Sylvestre Vincent.....	400	Goodyear, McKay, and mixed.

FRENCH BOOT AND SHOE MANUFACTURERS—Continued.

Names and addresses of firms.	Daily production.	Class of work.
LYON.		
<i>Pairs.</i>		
Blancher.....	125	McKay and mixed.
P. Carnat & Co.....	500	Goodyear and McKay.
A. Celle.....	200	Do.
Dezayaud Frères.....	800	Goodyear, McKay, mixed, and nailed.
G. Lepiant.....	800	Goodyear, McKay, and mixed.
Neyron & Co.....	300	Felt slippers.
Servajean.....	200	McKay and mixed.
TOULOUSE.		
E. Gardes.....	150	Goodyear, McKay, and mixed.
Georges Gril & Co.....	200	Do.
Louis Gril.....	300	Do.
H. Lenfant.....	600	McKay and mixed.
A. Molne.....	1,500	Goodyear, McKay, and mixed.
Nougayrol.....	900	Do.
A. Pons & Co.....	200	Do.
L. Vidal.....	600	Do.
FOUGÈRES.		
J. Bahu Fils Aîné.....	1,000	Mixed and McKay.
Vve. Bertin.....	200	Goodyear and McKay.
J. Cochet.....	1,000	McKay.
H. Cordier & Fils.....	2,500	McKay and Goodyear.
Girault & Sicard.....	600	McKay and mixed.
A. Morel.....	300	McKay.
J. Pichard.....	500	McKay and mixed.
OLORON.		
Bedat.....	3,000	Sandals (rope-soled shoes).
E. Bourgeade.....	150	Goodyear.
J. Carcabal.....	3,000	Sandals (rope-soled shoes).
Laferrère & Amadou.....	100	Goodyear, McKay, and mixed.
Laplace & Delor.....	250	McKay and mixed.
HASPARREN.		
J. B. Amespil Jeune.....	200	Rope-soled shoes.
Salvat Amespil Fils.....	800	McKay and mixed.
Sauveur Amespil.....	150	Do.
Haulon Frères.....	150	Do.
Hiriart Urruty.....	400	Do.
MARSEILLE.		
Augusto Cadet.....	900	Goodyear, McKay, and mixed.
Manufacture de Chaussures du Midi.....	800	McKay, Goodyear, and nailed.
Charpin & Fils.....	800	McKay, mixed, and slippers.
Ch. Trolliet.....	200	McKay and mixed.
NIÈMES.		
Ulysse Barre.....	500	Do.
Dupuis Aumeras.....	400	Do.
Ricout.....	100	Do.
L. Therond.....	1,000	McKay, mixed and slippers.
AMIENS.		
Humbelle.....	600	Goodyear and McKay.
G. Lenormand.....	150	Goodyear and nailed.
Muilliez Frères.....	400	Goodyear, McKay, and nailed.
Soufflet Vincent.....	125	Nailed.
OTHER PLACES.		
J. Clerico, Avignon.....	400	McKay, nailed, and mixed.
Nouveau & Favre, Avignon.....	150	McKay.
L. Paron, Avignon.....	150	Mixed, nailed, and McKay.
G. Biset, Bordeaux.....	200	Goodyear.
Calichon & Tachon, Bordeaux.....	700	Goodyear, McKay, and mixed.
Trolliet & Fils Aîné, Bordeaux.....	1,000	Slippers.
H. Boutry Fils, Lille.....	500	McKay and nailed.
Denis Pollet, Lille.....	300	McKay.
Hard Devos, Lille.....	200	Nailed.
Lemoine, Nantes.....	600	Goodyear, McKay, mixed, and nailed.
Perrouin Frères, Nantes.....	500	Goodyear, McKay, and mixed.
Michel Schwartz, Nantes.....	300	McKay and mixed.
Appalasse & Bidegain, Mauleonsole.....	2,000	Sandals (rope-soled shoes).
Établissement Louis Beguerie, Mauleonsole.....	3,000	Do.
P. Charbero & Co., Mauleonsole.....	15,000	Do.

FRENCH BOOT AND SHOE MANUFACTURERS—Continued.

Names and addresses of firms.	Daily production.	Class of work.
OTHER PLACES—continued.		
	<i>Pairs.</i>	
Beillard, Rouen.....	500	McKay.
J. Carton, Rouen.....	150	McKay and mixed.
A. Tauvel, Rouen.....	250	Do.
Vve. Ed. Aubin, Angers.....	200	Goodyear, McKay, and mixed.
J. Malbert, Angers.....	300	Goodyear, mixed, and nailed.
Etablissement Felix Ruinet, Dijon.....	1,000	McKay and slippers.
Société Anonyme des Chaussures Belorgey, Dijon.....	300	Goodyear, McKay, and mixed.
Société "La Quercitaine," Le Quesnoy.....	200	McKay, mixed, and nailed.
L. Vitrant, Le Quesnoy.....	200	McKay and nailed.
Gellée Fils, Mouy.....	500	Goodyear, McKay, and mixed.
Blassier, Beausang & Dupuis, Mouy.....	300	McKay and mixed.
Chassain Jardine, Pau.....	100	Do.
P. Lahitte Fils, Pau.....	2,000	Sandals (rope-soled shoes).
Carassou Frères, Pontacq.....	100	Goodyear.
Fouriscot, Pontacq.....	150	Do.
Faucheur Frères, Pont-à-Mousson.....	200	Goodyear, McKay, and mixed.
F. Mauroy, Pont-à-Mousson.....	100	Do.
Marcel Ouin, Pont de l'Arche.....	2,000	Slippers.
Georges Prieur, Pont de l'Arche.....	1,200	McKay.
Berthelot Frères, Rennes.....	150	McKay and mixed.
G. Dalsay, Rennes.....	200	Goodyear, McKay, and mixed.
Paulin Besson, St. Aigulin.....	200	McKay and mixed.
J. Delpech, St. Aigulin.....	100	Do.
Brun Durand & Roybet, St. Donat.....	400	Goodyear, McKay, and mixed.
Lagnel & Meyssonier, St. Donat.....	150	McKay and mixed.
Adelson Hulicq & Fils, Vieuxconde.....	150	Nailed and mixed.
Peltier, Vieuxconde.....	200	Goodyear, McKay, and mixed.
Gabriel Haon, Alais.....	150	Nailed and mixed.
Gounin Frères, Amboise.....	2,000	Slippers and McKay.
Nemeteau & Co., Angoulême.....	300	McKay and mixed.
Fils de A. F. Gontard, Avenières.....	500	Goodyear and McKay.
H. Berthier, Armentières.....	150	Mixed and nailed.
Rabany, Attigny.....	1,000	Slippers and McKay.
A. & R. Baque, Beauvais.....	200	Goodyear, McKay, and mixed.
Rousset Frères, Blois.....	1,000	Goodyear and McKay.
M. Auroux & J. Nevreux, Boulogne.....	250	Goodyear.
P. Millou, Bourq-de-Peace.....	100	McKay and mixed.
Lebrece Pagny, Briouze.....	1,500	Slippers and McKay.
Houdard & Fontaine, Cambrai.....	500	Goodyear, mixed, and nailed.
Molndron, Chalais.....	500	Felt slippers.
Tourtet Bouchet & Gamonet, Chateau-Renaud.....	300	McKay, nailed, and mixed.
Monteux, Chateau-Thierry.....	800	Goodyear, mixed, and veldtschoen.
Regnier Frères, Cremlieu.....	600	Goodyear, McKay, and mixed.
Lengagne Defosse Fils, Dosvres.....	200	Nailed and mixed.
Mederic Brihayé, Glageon.....	400	Mixed and nailed.
Bigot, Le Mans.....	200	McKay and Goodyear.
J. Olivier, Les Herbiers.....	800	McKay and nailed.
H. Chevron & Co., Izeaux.....	500	Goodyear.
Alfred Comevot, Liancourt.....	800	McKay, mixed, and Goodyear.
Balland, Lilbourne.....	300	Felt slippers.
Aubertel, Ligny en Barrois.....	2,000	McKay.
Fanien & Deléclis, Lillers.....	1,200	Goodyear, McKay, and mixed.
P. Auzary Aîné, La Roole.....	600	McKay and mixed.
Servonnat Frères, Morestel.....	300	Goodyear and McKay.
Bordeau & Trehu, Niort.....	200	Do.
Marbot, Neuvi & Gorse, Neuvi sur l'Isle.....	500	McKay and mixed.
Mille Père & Fils, Orange.....	150	McKay, mixed, and nailed.
Coudert, l'Erigeux.....	150	McKay and mixed.
Chapman & Fils, Les Praux.....	600	Do.
Les Fils de A. Brinon, Pussay.....	1,500	Slippers.
G. Pernot, St. Ay.....	200	McKay and slippers.
Bos Père & Fils, St. Christoly de Blaye.....	200	Mixed.
Fabrique de l'Abbaye St. Michel, St. Michel.....	400	Mixed and nailed.
Paul Ravalec, Ste. Savine.....	300	McKay and nailed.
Dupoizat Aîné, St. Symphorien D'Ozon.....	300	McKay, mixed, and nailed.
A. Dufour Fils, Sauve.....	1,000	McKay.
G. Pommier, Sens.....	200	Mixed and nailed.
Huillot Fils, Tonneins.....	600	McKay and mixed.
Lepez Brido, Tourcoing.....	400	Goodyear, McKay, and mixed.
Clerget Molroguier, La Tour Du Pin.....	200	Do.
Bourdais, Tours.....	300	Do.
Cowez Frères & Co., Trelon.....	200	Nailed.
Laine, Trun.....	150	Goodyear, McKay, and mixed.
Gautier & Fontellaye, Valenciennes.....	500	Goodyear, McKay, and nailed.
Pellet Aîné & Fils, Vienne.....	500	Do.
De Berall, Villeneuve sur Lot.....	150	Mixed and McKay.
Constant, Visan.....	600	Do.

FRENCH TANNERS.

Firm names and addresses.	Daily output.
UPPER LEATHER.	
A. Combe Fils & Cie. à St. Denis-Paris.....	1,200 dozen goatskins.
Ribes, Annonay (Ardèche).....	300 dozen calfskins.
Meyzonnier, Annonay (Ardèche).....	300 goat and 200 dozen calf skins.
Franc et Cie., Annonay (Ardèche).....	300 goat and 200 dozen sheep skins.
Tanneries Lyonnaises, Oullins.....	200 goat and 200 dozen calf skins.
SOLE LEATHER.	
Les Fils de Luc, Nancy.....	300 hides.
Willekens, La Flèche.....	Do.
Wauquiez et Fils, Mouvaux.....	250 hides.
Clovis Pouillet, Les Lannoy.....	Do.
Hardyau, St. Calais.....	Do.
Peltrean-Enault, Paris.....	Do.
Tanneries Lyonnaises, Oullins.....	200 hides.
LEATHER BELTING.	
Domange et Fils, Paris.....	250 hides.
Bienfait-Lemaire, Tourcoing.....	200 hides.
Leverd, Lille (Nord).....	150 hides.
Tanneries Lyonnaises, Oullins.....	Do.
Ulysse Roux et Cie., Romans.....	Do.
Ottenheim, Versailles.....	100 hides.
FANCY LEATHER.	
Floquet et Fils, St. Denis.....	500 dozen sheepskins.
Franc et Cie., Annonay (Ardèche).....	200 dozen sheepskins.
Maroquinerie Française, St. Denis.....	Do.
Rossero & Fils, Gentilly.....	150 dozen sheepskins.
Berthin, Gentilly (Seine).....	Do.
Chabbat, Graulhet (Tarn).....	250 dozen sheepskins.
Pagès, Graulhet (Tarn).....	Do.
Cathala, Graulhet (Tarn).....	Do.

SWISS BOOT AND SHOE MANUFACTURERS.

Names and addresses of firms.	Weekly production.	Class of work.
	<i>Pairs.</i>	
Schuhf. Kreuzlingen, Kreuzlingen.....	5,400	Men's, women's, and children's Goodyear welt, McKay sewn, pegged, and felt shoes, and men's and women's screwed.
E. & S. Weill (two factories), Kreuzlingen....	3,000	Men's and women's Goodyear welt, and men's, women's, and children's McKay sewn and screwed.
L. Raichle, Kreuzlingen.....	3,300	Men's, women's, and children's McKay sewn, pegged, and screwed.
"La Barque," Geneva.....	1,200	Men's, women's, and children's McKay sewn,
G. Reyboubet, Geneva.....	1,200	Men's, women's, and children's McKay sewn and men's and women's turned and felt.
M. Rochat, Geneva.....	1,200	Men's, women's, and children's McKay sewn and screwed and children's veldtschoen.
N. & S. Bondanini, Geneva.....	600	Men's, women's, and children's turned.
J. M. Stangelin, Herzogenbuchsee.....	600	Men's and women's pegged and screwed.
Ad. Stuber, Herzogenbuchsee.....	1,800	Men's and women's McKay sewn, pegged, and screwed.
Ad. Schenker, Olten.....	1,200	Men's, women's, and children's Goodyear welt and screwed.
Strub, Glutz & Cie., Olten.....	9,000	Men's, women's, and children's Goodyear welt, McKay sewn, turned, pegged, felt, and screwed.
Burrus & Kohler, Pruntrut.....	1,200	Men's and women's McKay sewn and screwed.
Schuhf. "Minerva," Pruntrut.....	1,800	Men's, women's, and children's McKay sewn and screwed and men's and women's pegged.
Brattler-Stehli, Winterthur.....	1,200	Men's and women's McKay sewn and screwed.
Hofman & Co., Winterthur.....	900	Men's and women's Goodyear welt, McKay sewn, and screwed and children's screwed.
Hans Fretz, Aarau.....	1,200	Men's, women's, and children's McKay sewn, pegged, and screwed.
C. F. Bally A. G., Schoenenwerd.....	66,000	Men's and women's Goodyear welt, McKay sewn, turned, pegged, felt, and screwed, and children's McKay sewn, turned, pegged, felt, veldtschoen, and screwed.

SWISS BOOT AND SHOE MANUFACTURERS—Continued.

Names and addresses of firms.	Weekly production.	Class of work.
	<i>Pairs.</i>	
Walder-Appenzeller & Söhne, Bruttisellen..	9,000	Men's, women's, and children's Goodyear welt, McKay sewn, turned, pegged, felt, and screwed, and children's veldtschoen.
Schuhf. Frauenfeld, Frauenfeld.....	4,800	Men's and women's Goodyear welt, McKay sewn, turned, pegged, felt, and screwed, and children's Goodyear welt and McKay sewn.
Gebr. Henke, Stein.....	2,400	Men's and women's pegged and screwed and children's screwed.
Schuhf. Baden A. G., Baden.....	2,400	Men's and women's McKay sewn and men's and children's screwed.
Zuberbühler & Cie., Zursach.....	2,400	Men's, women's, and children's McKay sewn, pegged, and screwed.
Schuhf. Amriswill, Amriswill.....	2,700	Men's and women's McKay sewn and screwed and children's veldtschoen.
Schuhf. Brittnau, Brittnau.....	1,800	Men's and women's McKay sewn and screwed and children's screwed.
Schuhf. Freiberg, Freiberg.....	1,500	Do.
A. Löw & Cie., Übersach.....	1,500	Men's and women's McKay sewn, pegged, and screwed.
Schuhf. Allschwil, Allschwil.....	900	Do.
Schuhf. Buochs, Buochs.....	1,200	Men's and women's McKay sewn and screwed.
Schuhf. Baden A. G., Lenzburg.....	600	Men's and women's pegged.
Dierauer-Forrer, Oberuzwil.....	600	Men's and women's McKay sewn and screwed and children's veldtschoen.
Schuhf. Liestal, Liestal.....	600	Men's, women's, and children's McKay sewn and screwed.
Schuhf. Weinfelden, Weinfelden.....	600	Men's, women's, and children's felt shoes.
Russ & Cie., Diessenhofen.....	300	Men's and women's pegged.
Hans Zehnder, Kölliken.....	300	Men's, women's, and children's pegged and screwed.
Hug & Cie., Herzogenbuchsee.....	1,800	Wooden shoes.
Depuis Frères & Cie., Martigny.....	1,800	Do.
Allenspach, Kurzrickenbach.....	600	Do.



DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF MANUFACTURES

A. H. BALDWIN, Chief

SPECIAL AGENTS SERIES—No. 59

MINING IN THE FEDERATED MALAY STATES

By

D. C. ALEXANDER, JR.

Commercial Agent of the Department of Commerce and Labor

TRANSMITTED TO CONGRESS IN COMPLIANCE
WITH THE ACT OF MARCH 4, 1911, AUTHORIZING
INVESTIGATIONS OF TRADE CONDITIONS ABROAD



WASHINGTON
GOVERNMENT PRINTING OFFICE
1912

LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE AND LABOR,

Washington, August 6, 1912.

SIR: I have the honor to transmit herewith, in accordance with the act making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ended June 30, 1912, approved March 4, 1911, a report by Commercial Agent D. C. Alexander, jr., of this department, containing the result of his investigations of mining in the Federated Malay States.

Respectfully,

BENJ. S. CABLE,

Acting Secretary.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL

DEPARTMENT OF COMMERCE AND LABOR,

BUREAU OF MANUFACTURES,

Washington, June 24, 1912.

SIR: I have the honor to submit herewith a report by Commercial Agent D. C. Alexander, jr., on mining in the Federated Malay States, with special reference to methods and equipment and the market for American machinery and supplies.

Respectfully,

A. H. BALDWIN,

Chief of Bureau.

TO HON. CHARLES NAGEL,

Secretary of Commerce and Labor.

MINING IN THE FEDERATED MALAY STATES.

INTRODUCTION.

The Federated Malay States, a little-known colony of the British Empire, comprise the four Federated States of Perak, Selangor, Nigri Sembilan, and Pahang, and the three native States of Kedah, Kelantan, and Trengganu (recently ceded by Siam), having a total area of nearly 43,000 square miles. It may be expected that, in course of time, the now nominally independent State of Johore will also enter the federation. Each State is governed by a British Resident, in the name of the Malay Sultan; and Federal authority, both executive and legislative, is in the hands of a high commissioner, who is also governor of the Straits Settlements, and the Federal Council, all appointed by the Crown.

The development of the colony has been marvelous. In the early days tin mining was the only industry of importance, but in the past 10 years the cultivation of rubber has received almost equal attention, and in 1910 the area planted in rubber (295,000 acres) exceeded that under mining lease. Out of the very large profits of the miners and planters the State and Federal Governments have taken a heavy tithe in the form of export duties, but the sums so collected have been wisely expended in opening up the country by the building of roads, railways, and harbors. Of metaled roads there are now over 2,000 miles; while the Federal Railway has a mileage of about 650, which is being rapidly increased. Notwithstanding the heavy capital expenditure required by these improvements, the Federated Malay States are not only free of debt, but have a large surplus, out of which loans are made to planters, thus greatly assisting in the development of the country. Kuala Lumpur is the Federal capital.

POPULATION—IMPORTANCE OF MINING.

The population of the four Federated States is now about 850,000, Europeans numbering only 3,000 to 4,000, Chinese and Malays each about 350,000, and Indians 150,000. The currency of the colony is the Straits Settlements dollar, having a fixed value of 2s. 4d., or \$0.5677. The standard of weight is the picul, equal to 133½ pounds, which is divided into 100 catties.

The importance of the mining industry in the Federated Malay States is shown by the export returns for 1910. In that year the total exports amounted to \$58,111,380,¹ of which tin contributed \$32,268,851, or 55.5 per cent of the whole; gold, \$325,950, or 0.56 per

¹ Values are in United States currency unless otherwise stated.

cent; and wolfram, \$26,781. Of the remainder, rubber constituted 26 per cent, leaving only about 18 per cent for all other exports. In 1911 the value of tin produced rose to \$39,500,000, but as rubber also increased greatly the relative importance of the metals produced remained about the same as in 1910.

GOLD MINING.

The production of gold in Perak in 1910 was 898.5 ounces, as compared with 1,278.8 ounces in 1909; Pahang, 15,868.5 ounces, against 14,887.7. Nigri Sembilan produced none in 1910 and only 76.9 ounces in 1909.

Nigri Sembilan having ceased to produce gold in paying quantities it is now mined in only two places, the mines of the Raub Australian Gold Mining Co., of Raub, Pahang, which in 1910 yielded 87 per cent of the entire gold production of the colony, and in the alluvial workings of the Kuala Lipis district of the same State. The workings in Perak are on a very small scale, being principally in the hands of Chinese, who pan the river sands in several places. A large number of gold workings have been started at various times in Pahang, but in almost every instance the returns have been too small to justify their continuation, and they have been abandoned. However, none of these workings was carried to a depth of more than 500 feet, and should the test shaft which is now being sunk at Raub disclose new veins of paying ore, many of the workings now idle would doubtless be reopened.

THE RAUB MINES.

The Raub mines, which are near the town of Raub, in the State of Pahang, consist of three shafts, Bukit Malacca, Bukit Koman, and Anderson. The first named has a depth of about 700 feet, and is to be sunk to 1,000 feet in the hope of discovering richer quartz than has yet been found. The writer visited only the shallowest working, the Anderson shaft, which has a depth of about 250 feet, and is being developed on only one level. The gold-bearing quartz lies in irregular veins 1 to 3 feet thick, surrounded by a close-grained black rock. The method of working is to open the drifts about 6 feet wide and 12 feet high, taking out the lower strata of quartz first, and then erecting a staging 6 feet above the drift floor. Chutes are let in through this staging, and the refuse from the upper part of the drifts and from the stopes is dumped through these chutes until the lower half of the drift is refilled.

The labor underground is all Chinese and on a contract system, by which a Chinese contractor is paid at a fixed rate per ton for quartz delivered at the shaft bottom. The rate of payment could not be ascertained, but the contract is usually awarded to one of several bidders, and the rate varies with the nature of the workings and their distance from the shaft. In the Anderson shaft manual labor only is used for drilling and transporting ore and refuse, though a light railway with small trucks is provided. In the other shafts a few air drills are in use, but the tramming is done by hand.

PUMPS—MILL EQUIPMENT.

The mine pumps are, with one exception, of the old Cornish design, having a huge walking beam at the shaft head, from one end of

which the wooden pump rod descends to the mine sump and operates a plunger in a long cylinder, the plunger and rods being counter-balanced at the surface. However, the usual steam cylinder at the surface has been eliminated, and the beam is actuated by an electric motor through a lay shaft and flywheel coupled to the beam by a connecting rod. The dimensions of the pump at the Anderson shaft are: Cylinder diameter, 16 inches; stroke, 14 feet; pump rod, 270 feet long by 10 inches in diameter. With an 80-horsepower motor, and at six strokes per minute, the pump raises 450 gallons per minute. While this efficiency is not high the mine engineer argues that this style of pumping is thoroughly satisfactory, since neither the pump nor the motor requires the repairs that would be necessary for a pumping outfit placed in the mine.

When the ore trucks reach the surface they are hauled by light locomotives to the upper floor of the mill, where the ore is dumped over grizzlies into hoppers, and then passes to the rotary crushers. The crushed ore passes by gravity through other hoppers to the stamps, which are of the gravity pattern, five batteries of eight stamps each in a single row. From the mortars, which contain amalgamated copper plates, the pulp flows through a screen upon the amalgamated apron plates, thence to a mercury trap, and, finally, over the concentrating tables. The crushers, stamps, and tables bear the name of a Melbourne, Australia, engineering company. The plant has a complete outfit of tanks, etc., for cyaniding the tailings. but this has been found unprofitable and has been discontinued.

POWER PLANT.

Power is supplied from a hydroelectric station, which has been erected by the company in the mountains some 6 miles from the mines. In this plant 500 horsepower is generated, the current being transmitted as two-phase alternating, at 5,000 volts, which is transformed at the mine to direct current at 220 volts. All the motors and transformers are from the Oerlikon factory, at Winterthur, Switzerland; the dynamo at the power station is from the same makers, while the water turbine is from Escher, Wyss & Co., of Zurich. In addition to the water-generated power, boilers and engines totaling about 100 horsepower are maintained at the mine. These are in small portable units and serve principally as stand-bys in case of accident to the electric plant. About 300 horsepower is consumed in pumping the three shafts, the remainder being used for the mine hoists and mill machinery. There are two single-cylinder belt-driven air compressors, with cylinders 10 inches in diameter and 12-inch stroke, from the Sullivan Machinery Co., of Chicago. Both are driven by one 30-horsepower motor and 80 pounds air pressure is maintained. These compressors are running very nicely, but are said to be inadequate, since most of their output is consumed at present in driving a large reciprocating pump in one of the shafts, leaving insufficient power for air-drills. However, it is expected that the air-driven pump will soon be replaced by one of another type, possibly a centrifugal, which will permit the use of a greater number of air drills. In the Anderson shaft there is no electric lighting, and the writer is not informed on this point regarding the other shafts.

REPAIR SHOP—LABOR—OUTPUT.

As the mine is about 15 miles from the nearest railway and 50 miles from the nearest commercial machine shop, it is compelled to maintain its own repair shop, which includes a small cupola, several forges, two or three lathes, and shapers and upright drills of various sizes. Almost without exception the machinists, as well as the workmen in the mill, are Malays. The total labor force of the mine is from 750 to 800 men, including the contract Chinese miners. Although exact figures are not available, the average rate of pay does not exceed \$0.45 per eight-hour day for Chinese and \$0.40 for Malays.

The output of the mine in 1910 was 14,555 ounces of gold, recovered from 55,137 tons of quartz crushed, an average of 0.264 ounce per ton. In 1909 the output was 14,510 ounces from 71,973 tons of quartz, an average of 0.2016 ounce per ton. From this it will be seen that, taking the value of gold at \$19.40 per ounce, the yield per ton of ore crushed was \$3.91 in 1909 and \$5.12 in 1910. Considering the low cost of power and labor in the Raub mines, the net profit of the workings should be fairly large, since several gold mines in the Black Hills of Dakota have earned satisfactory returns from quartz yielding only \$3.60 to \$4 per ton.

TIN MINING.

Tin mining is of vastly greater importance in the Federated Malay States than all other classes of mining combined, because of the widespread occurrence of the ore and the high commercial value of the tin. In 1910 a total area of 280,254 acres of land was leased for tin-mining purposes from the Federated Malay States Government, which retains ownership of all mining lands and leases them at a nominal rental, subject to Government inspection and regulation. The production of tin in each State is shown by the following table, in tons of 2,000 pounds:

States.	1910	1911
	<i>Tons.</i>	<i>Tons.</i>
Perak.....	28,080.01	29,155.93
Selangor.....	16,012.78	15,411.65
Nigri Sembilan.....	2,315.17	1,948.69
Pahang.....	2,711.59	2,930.28
Total.....	49,128.55	49,446.55

In 1910 the average value in Singapore was \$656.90 per ton, and in 1911 \$796.65.

NATURE OF DEPOSITS—QUARTZ.

The tin is usually found in the form of cassiterite, an impure stannic oxide (SnO_2), and was undoubtedly originally deposited in the metamorphic granite of the mountains and hills of this region. Lodes of the ore are found in many places in the granite in the form of an onyx quartz, and the working of this quartz has been frequently undertaken. However, the quartz workings have seldom been successful, since the profit derived from them compares very unfavorably

with what can be earned from even the low-grade alluvial deposits. It is generally held by mining engineers of this district that quartz workings will not become numerous or profitable until all but the very lowest grades of alluvial deposits have been exhausted, which will probably not be for another 25 or 30 years. Moreover, should large alluvial deposits of tin ore be found in the recently acquired Provinces of Kedah, Kelantan, and Trengganu, where prospectors are already at work, the day of the quartz working will be further postponed.

On the other hand, there are a few quartz deposits so rich that thoroughly experienced miners are not hesitating to erect the expensive mills necessary for working them. One such plant is that of the Menglembu Lode Syndicate, near Ipoh, in which 20 stamps and 5 concentrating tables driven by gas engines produced 196.4 long tons of tin in 1910. Another mill is now being erected near Bentong, Pahang, by Messrs. Ruxton and Bibbey, both miners of much experience in the Federated Malay States and Australia. Moreover, the Government of the Federated Malay States has very recently agreed to a proposal of the Mine Owners Association that reductions of not more than 50 per cent of the export duty on tin and tin ore shall be granted to miners who can show that the properties which they are working are of so low a grade that a reasonable profit can not be earned if the full duty be exacted. As this measure will doubtless apply to mines in which the high cost of winning the tin leaves only a small margin of profit, it should have the effect of encouraging quartz mining.

ALLUVIAL DEPOSITS.

The alluvial deposits of tin ore are very widely scattered, but the richest are usually found lying close to the slopes of hills or mountains, narrow valleys being most productive. This is easily explained on the theory that the disintegrated granite which contains the tin was washed down the slopes by rains and streams, and the tin ore, because of its weight, remained in pockets close under the slopes, while the sand that accompanied it was carried to a greater distance. That the streams in the valleys carried away the granitic sand and continuously deposited silt is shown by the fact that the richest ore is found in beds of clay. The famous and wonderfully rich Kinta Valley of Perak is an excellent example of the formation described and will for that reason receive special attention in this report. The valley is about 30 miles long, with an average width of 5 to 6 miles, and the hills on either side rise to an elevation of 300 to 400 feet. On the west side of the valley the granite of the hills slopes down until it meets the limestone floor, while on the east side of the valley the hills are flanked by cliffs of limestone outcrop. The Kinta, Sorakai, and several smaller streams flow through the valley. The richest ore deposits lie on the west side of the valley, but the east slope has what the west slope lacks—an abundant supply of water, by means of which the lower grades of ore can be profitably worked.

METHODS OF MINING.

In times past a considerable amount of tin-bearing soil, or “ka-rang” as it is called locally and will be designated hereafter in this

report, has been raised by means of shafts, never exceeding 150 feet in depth and probably averaging not more than 50, and a certain amount is still so mined. But the opencast working has so rapidly superseded the shaft that the latter is now hard to find, except as old drifts are uncovered in mines that are now worked opencast. This is a natural outcome of the steadily increasing value of tin and the depletion of virgin karang. In 1895, when the price of tin was \$280 per long ton, only the richest karang could be profitably worked, and this was most cheaply reached by shafting. When the ore bed began to decrease in richness it was abandoned and new workings started. However, 10 years later, when the price of block tin reached \$850 per long ton, the mine owners realized the advantage of removing the overburden and carefully treating grades of karang that had been formerly despised. Moreover, virgin karang is now comparatively rare, and many mines are earning a good profit by reworking the dumps and tailings of old properties.

The following table shows the number of laborers employed in each class of tin mining in 1909 and 1910:

Class.	1909	1910
Opencast.....	137,156	122,698
Underground.....	18,198	19,154
Lampan.....	28,024	28,521
Unclassified.....	1,321	

Lampan mining may best be described as similar to the ground sluicing of the early California days, the method being to divert a portion of a small stream through a ground sluice, into which the karang is hoed and stirred by hand until the earth is washed away, leaving the ore in the bottom of the sluice. This method is confined to small surface workings, usually owned by Chinese who have too little capital to employ better methods. The remaining underground workings also are almost entirely Chinese mines, and many are worked without the aid of machinery, the karang being raised by means of ladders or hand windlasses. However, to prevent a mistaken impression, it should be noted that, while a majority of the Chinese-owned properties are worked by rather crude methods, some of the best-equipped mines in the Federated Malay States are owned and operated by Chinese, and that, according to the figures of the Senior Warden of Mines, 78 per cent of the total output of tin in the year 1910 was produced from mines owned and operated by Chinese.

The methods by which the principal mines are worked may be classified as (1) opencast, (2) hydraulic, and (3) underground; and, for the purposes of this report, hydraulic mining will be subdivided into (1) natural power, and (2) generated power.

OPENCAST MINES.

Opencast mines are by far the most numerous, since the class includes workings ranging from the tiny plots of "tributers," where one Chinese and his family pan out a few hundred pounds of ore in a year, up to the great Tronoh and Tambun mines, which hold the

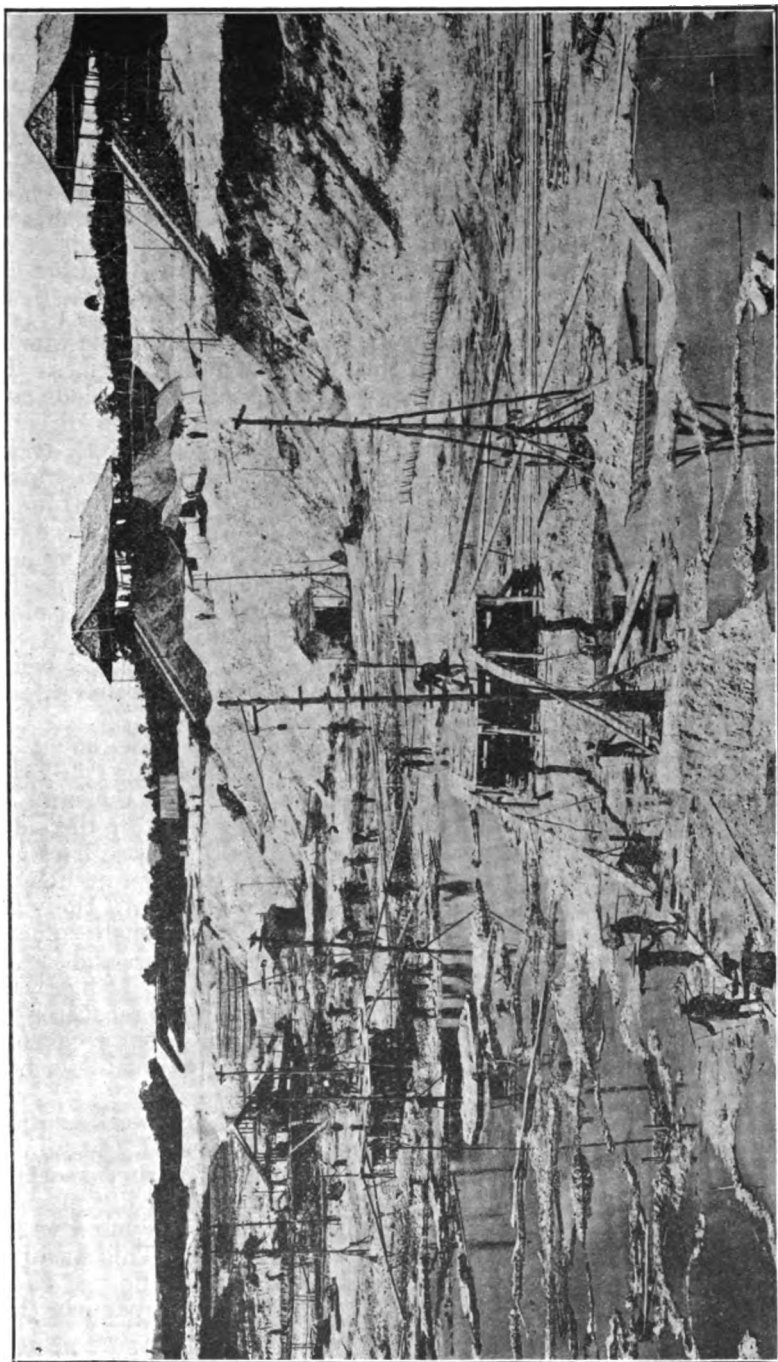


FIG. 1.—Kuala Kubu opencast mine.

records for production. Needless to say, the amount of machinery used varies with the size and richness of the mine, but as even the largest employs no great plant, we may at once pass over the smaller ones and proceed to a consideration of typical mines and mills of major importance. The main difference in the larger opencast mines lies in the amount of power used and in the machinery for developing such power. The method and apparatus for treating the karang are practically the same in all mines. Therefore, before considering the subject of power and power plants, a description will be given of the typical ore mill which is to be found at every opencast or underground mine of considerable size.

ORE MILLS.

In almost every case the karang is raised to the mill by means of small trams, which are hauled up inclines by winding engines. In the mill the karang is dumped upon grizzlies, and the clods are broken up by hand until the earth passes through, falling directly into the puddlers, which are circular tanks of wood or concrete, about 15 feet in diameter and 6 feet deep, with an inlet for fresh water, and an overflow pipe with screen set about 2 feet above the bottom of the tank. In the puddlers the karang is agitated by two or more harrows or "drags," suspended from four arms which rotate upon a vertical shaft set in the center of the tank. These vertical shafts are driven through bevel gears by a main shaft which passes close over the row of puddlers, a clutch permitting each puddler to be cut out for cleaning. A carefully regulated supply of fresh water being pumped into the puddlers, there is an equal overflow of slime, which passes through open troughs to the riffles.

The riffles consist of wooden troughs 4 to 6 feet wide, about 12 inches deep, and from 50 to 80 feet long, the incline being 1 in 25 to 1 in 30, depending upon the fineness of the ore which the mine is producing. At intervals of about 4 feet cleats are nailed to the sides of the trough, in which bars of hardwood are laid. These bars are usually 2 inches square in cross section, and as the deposit behind them gradually rises one bar is placed above another until the riffle is filled and has to be cleaned. Several riffle boxes are usually placed side by side under a thatched roof, and coolies pass up and down agitating the deposits with a kind of two-pronged hoe. It has been found that fully 90 per cent of the ore in the karang is recovered in the riffles, in addition to which a small amount is often recovered from the tailings by tributers, a class of labor that will be described later.

When the riffles become filled, which may be once a week or once a month, depending upon the amount of karang treated, the supply of slime is cut off, the crossbars removed, and the deposit raked out. As it comes from the riffles the ore still contains a varying proportion of sand and other impurities, which are removed by hand washing in pans, No. 60 being the usual mesh of the screen. This washing is done by coolies over coffin-shaped boxes with a small flow of clean water, several traps being provided to catch the finest particles before the water is finally wasted.

In most alluvial mines small amounts of ore are occasionally found inclosed in quartz pebbles, which remain in the puddlers and must

be crushed before further treatment. For this purpose some of the large mines maintain a small battery of four or five stamps of the gravity type, but the crushing is more commonly done in a kind of mortar (introduced by the Chinese) in which the crushing shoe is hung at the end of a beam, which rests on a fulcrum and is actuated by the foot power of coolies. From the stamp the crushed material goes to the washing pans.

The clean ore is dried in a perforated cylinder placed around a cone-shaped stove, which may be fired with coal, wood, or charcoal. If the ore is known to contain any considerable amount of wolfram this is then removed by ordinary horseshoe magnets, which are passed over thinly spread layers of the ore and finally the ore is sacked, 1 picul (133½ pounds) to a sack, and stored until shipped to the smelter.

POWER SUPPLY.

Power is required for (1) drainage pumps and fresh-water supply pumps; (2) moving karang and overburden in the mine and to the mill; (3) mill operation, such as driving puddlers, stamps, etc., and dynamos, the latter usually for lighting only, since practically no motors are now in use in the opencast mines.

In the small mines many of these services are performed by man power, as, for example, the operation of the Chinese type of stamps already described, or the transportation of the karang to the mill on the backs or heads of coolies. Moreover, many Chinese pumps are still seen in operation, both for drainage and to supply water to puddlers and riffles. Because of their widespread use, these Chinese pumps deserve description. They consist of an endless chain of wooden floats strung about a foot apart upon two ropes. The floats fit snugly in a long, inclined wooden trough, which rises from the sump to the surface at an angle of 30° to 45°. At the surface the floats pass over a large wooden drum and empty into a discharge trough. The staves of the drum, which is 6 to 12 feet in diameter, are spaced 1 to 2 feet apart and, upon the outside of this endless ladder, one or more coolies climb like squirrels in a revolving cage, turning the drum by their weight. As the maximum lift of such a pump is only about 30 feet it becomes necessary, when the water must be carried to a greater height, to place them in stages, one pumping to another. Even with the low wages that prevail in the Federated Malay States this method of pumping is recognized as expensive, and power pumps are rapidly displacing these antiquated devices.

Ten years ago the best-equipped mines generated all their power in small steam units, one for the drainage pumps, one for the supply pumps, one for each winding engine, and one for the mill; and even to-day a majority of the larger mines are so equipped. But with the rapidly increasing cost of wood for fuel the gas producer and gas engine came into use and they are now to be found in most of the up-to-date mines. The cost of this power varies with the cost of coal, which, since none has yet been mined in the Federated Malay States, must all be imported. A few plants are run upon Welsh anthracite, which costs laid down in Ipoh \$16 to \$17 per ton; others use semianthracite "Hongay" from China, costing \$11 to \$12 per ton.

A majority use, both in producers and under boilers, the very poor Bengal or Borneo coals, which can be had at \$5.50 to \$6.50 per ton delivered in Ipoh.

SMALL UNIT INSTALLATIONS—OIL AS SOURCE OF POWER.

It is surprising, however, to note that even when the producer and gas engine are employed they are generally in small units and are largely supplemented by steam power. Since the power in any mine must be widely distributed, it would seem that the economy of central electric stations and motor-driven pumps and machinery would be quite apparent, and the arguments of the mine owners against them are of interest. They say that, in the first place, the richness of a given mine or tract of land can not be ascertained in advance, as the karang does not run in well-defined veins, and test borings are of little value. Therefore, even if the first workings disclose rich earth, no one can foretell how soon it will be exhausted or what the life of the mine will be. For this reason owners decline to risk the initial expense of central power stations. The total cost of the small units required under present methods may be as much as that of a central power station with the necessary motors; but it is argued that these small units can be purchased from time to time as the mine justifies the expense, and that when the mine is exhausted they can be readily sold or transferred to other workings.

Another argument against the large electric plant is that the Chinese and Malay engineers who operate the small steam and gas plants (and these only indifferently well) would not be competent to keep in order a large electrical installation. Moreover, the great fluctuations that have occurred in the price of tin must be considered, as many mines making a fair profit at present prices would have to close down should the price of tin drop 25 per cent.

In spite of all these objections, the writer believes that the central electric station, generating from 200 horsepower upward, will be the next feature of opencast mine improvement in the Federated Malay States. It may also be confidently predicted that oil will soon become the chief source of power in the mining district, as it is fast becoming in the rubber-growing fields. When one considers that the enormous oil fields of Sumatra, Java, and Borneo are within 300 miles of Ipoh, he is amazed to find that in 1910 only 6 tons of fuel oil were imported into the whole State of Perak. In the same year Selangor, the principal rubber-producing State, imported 1,545 tons and Pahang, where wood fuel is still cheap, 1,801 tons.

TYPES OF BOILERS AND ENGINES IN USE.

Of the small power units generally in use the boilers are almost invariably of the portable type, 20 to 50 horsepower, and carrying 50 to 80 pounds working pressure. These supply steam to the winding engines, the mill engines, and in many cases to reciprocating steam pumps for drainage or riffle supply; but for pumping service the combined portable boiler and engine, driving a centrifugal pump, is largely employed. The centrifugal pumps range from 2-inch to 6-inch, depending upon the quantity of water to be handled, and are always single stage, as the discharge head never exceeds 175 feet.

The winding engines are usually of the horizontal duplex type, cylinders 6 by 10 inches to 10 by 18 inches, with drum 3 to 5 feet in diameter. The steam engines used for driving the mills are, of course, of many different makes and sizes, but with very rare exceptions they are simple, slide-valve, noncondensing engines, generating 30 to 60 horsepower.

As has been mentioned, the best equipped mines are now driving their mills (but seldom their pumps and winding engines) from producer-gas engines. All the producers and engines that the writer has seen in the mines visited are from three makers—Fielding & Platt, of Gloucester; the Hornsby-Stockport Co.; and Ruston, Proctor & Co.—all English makers. The producers are of the suction type, with wet and dry scrubbers, and most of the engines are of the single-cylinder four-cycle design, generating 30 to 60 brake horsepower. The units are frequently installed in duplicate to provide against breakdowns and to permit of alternate cleaning in mines that operate continuously. Mine managers speak highly of these outfits, and the Chinese and Malay engineers appear to run them with little difficulty and few accidents. The writer saw no oil engines at any of the mines visited, though informed that in the Kuantan mine, in Pahang, Diesel engines, aggregating 245 horsepower, are in use and are proving very satisfactory. To illustrate the above general description, detailed accounts follow of two well-known opencast mines.

THE TAMBUN MINE.

The Tambun is often called the "show mine" of Perak, because its owner, Towkay Leong Fee, not only welcomes visitors, but keeps his property in such perfect order that one might almost think it was maintained purely for their benefit. That such is not the case is proved by the fact that the Tambun has held (and probably still holds) the record for a year's production, its output in 1907 or 1908 having been 3,600 long tons of ore. At present the owner is voluntarily curtailing production by working his mine on a nominal eight-hour day, whereas most other mines are running continuously day and night. While leaving the question of labor for later discussion, it may be said that in most opencast mines the karang and overburden are raised from the mine either by contract or by piecework. In the Tambun mine the raising of 80 trucks of spoil for each man in a gang constitutes an eight-hour day for Chinese laborers, and for this amount each is paid \$0.33. If by rapid work or by working overtime the gang exceeds the average of 80 trucks per man, the pay is increased pro rata. This explains why the tram pushers in the Tambun are usually seen moving at a run. (Fig. 2.) About 700 Chinese are employed and 200 Indians, the latter all Tamils and Punjabees. As the Indian does not equal the Chinese as a workman his pay is proportionately less, being \$0.255 per eight-hour day.

EQUIPMENT OF TAMBUN MINE.

For raising spoil there is a light railway and trams, but no locomotives; three inclines, two of which are employed for the removal of overburden, each with double tracks; and three winding engines

with continuous steel cables, so that descending empties partially counterbalance loaded trams ascending. These winding engines, from Ransomes, Sims & Jeffries, of Ipswich, England, are simple duplex, with cylinders 10 by 18 inches. They are supplied with steam, at 60 pounds pressure, from four portable boilers built by the Wantage Engineering Co., of Wantage, England.

The drainage pumps are one 8-inch and two 6-inch centrifugals, driven by portable combined boilers and engines from Ransomes, Sims & Jeffries, and pumping against a total head (suction and discharge) of about 60 feet. The fresh-water service for puddlers, riffles, etc., is maintained by a very neat little pumping station, in which power is generated by a 35-horsepower single-cylinder four-cycle gas engine, supplied by two suction producers which are operated alternately. Engines and producers are from the shops of

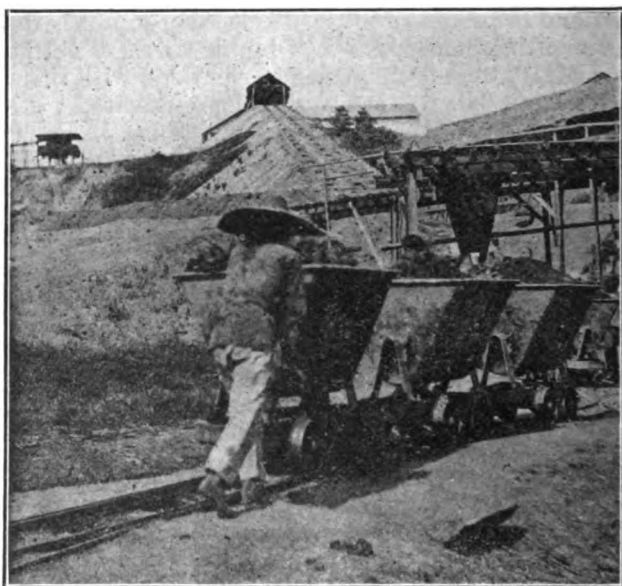


FIG. 2.—Haulage incline at Tambun mine; mill at top; trams in foreground have capacity of 20 cubic feet each.

Fielding & Platt. The impellers of both pumps, which are 6-inch centrifugals from Gwynnes (Ltd.), of Birmingham, are mounted upon the same shaft, each with a clutch, so that they can be run singly or in pairs. They are pumping against 35 pounds head.

The mill contains four primary and six secondary puddlers constructed of concrete. This is the only mill the writer has seen in which puddling is done in two stages. The arms of the puddlers are driven through the usual shaft and bevel gears by two producer-gas engine sets of 35 horsepower each, duplicates of the set in the pumping station, and from the same makers. When all the puddlers are in use both engines are required. As lighting for night work is not needed, no dynamo is operated.

Since the Tambun has its own smelter, a small mill for coarse concentration is maintained. This consists of one 5-foot Huntington

mill, manufactured by Davey, Paxman & Co., of Colchester, England; a set of four standard revolving trommels (pitch 1 inch to 1 foot); and four four-compartment Hartz jigs, each taking the feed from one trommel. There is also a small concentrating table of the Overstrom type; the whole mill is driven by a small steam engine.

CHINESE SMELTER.

The smelting plant is of a simple Chinese type, but gives very satisfactory results. Five furnaces similar to the one shown in figure 3 are in use, charcoal being used as fuel and a small amount of limestone as a flux. The blast for each furnace is maintained by a coolie, who pushes and pulls a square, single-acting piston in a wooden box

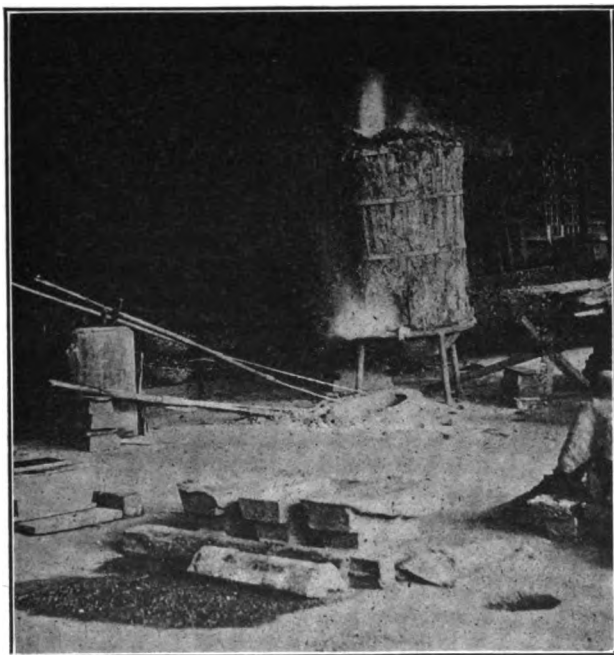


FIG. 3.—Typical Chinese smelting furnace for tin ore.

5 to 6 feet long. The intermittance of this blast does not seem to be detrimental to the smelting process; indeed, the results were not so good when a rotary blower was installed a short time ago. The Chinese attributed the unsatisfactory working of the mechanical blower (which was probably due to mishandling for the purpose of securing the reemployment of the dismissed blower coolies) to the fact that the supply from the rotary fan was not the same kind of air as that derived from the hand-power blowers. The slag trickles down into an iron receptacle, shown in front of the furnace, where the scum is removed by a strainer and returned to the furnace; the clean molten tin is then ladled into the molds. Although the Tam-bun is the only mine the writer has seen that smelts its own ore, there are many small Chinese smelters scattered about Perak, which

somehow manage to run in competition with the two large well-equipped, European-style smelters in Singapore and Penang.

In 1910 there were removed from the Tambun mine 684,730 trucks of overburden and 250,703 trucks of karang, from which 621 long tons of ore were recovered.

THE LAHAT MINE.

The Lahat mine resembles in general features the Tambun, except that the workings are long and narrow, for which reason the company has installed two small locomotives for moving karang and overburden in the mine; the spoil is raised to the surface on the usual incline by a steam winding engine. There being an insufficient supply of fresh water for the puddlers and riffles, it has been found necessary to pump the drainage water into shallow ponds, from which, after the mud has settled, it is pumped to the mill and riffles. When this supply is not sufficient, as sometimes occurs when the rainfall is below normal, the water from the riffles must be likewise impounded and used again after the tailings have settled out. The drainage pump is a large duplex affair fed by a portable boiler. Coal for this boiler is handled on an aerial ropeway.

The puddlers, riffles, and washing sluices are similar to those already described. The power plant is equipped with a steam engine and boiler, and with a 120-horsepower duplex four-cycle gas engine, running at 200 revolutions per minute, which, with two producer outfits of 160 nominal horsepower each, are from Fielding & Platt (Ltd.). The producers, which are run on Welsh anthracite, are operated alternately, and the steam plant is reserved as a stand-by. As the mill is run continuously, an ingenious arrangement has been made for quickly cutting in the steam engine in case of trouble with the gas engine or plant. By this arrangement the crank shaft of the steam engine is used as a lay shaft, the gas engine being belted to a pulley on one end, while the main belt to the mill runs on a pulley at the other end. This device has been found very convenient, though a small amount of power is wasted in keeping the steam engine's piston and connecting rod in motion when steam is not up.

In addition to furnishing power for the puddlers, which absorb 10 to 15 horsepower each, the plant drives a 5-horsepower dynamo for lighting and also two centrifugal pumps that supply the puddlers and riffles. These pumps, which are from Gwynnes (Ltd.) have a capacity of 1,250 gallons per minute each, and their impellers are mounted on the same shaft, each with a friction clutch.

OUTPUT OF LAHAT MINE—LABOR.

In 1910, 298,000 cubic yards of spoil were raised from this mine, of which 65,000 cubic yards were overburden, and 548 long tons of ore were recovered. The Lahat ore averages 74 per cent pure tin, which is rather higher than the average for the whole mining district. At the present time about 700 men are employed and 22,000 cubic yards per month are being raised, from which 36 to 38 long tons of ore are secured. The spoil is moved by contract with Chinese and Tamil foremen, the former receiving 7.9 cents and the latter 6.8 cents per truck of 20 cubic feet delivered in the mill. The difference in rate

of pay is due to the fact that the company supplies the Tamils, but not the Chinese, with tools, and also that the compulsory contribution of the company to the Tamil immigration fund, described later, amounts to a charge of about 1.1 cents per cubic yard. The Chinese work 8 hours per day, 4 on and 8 off, while the Tamils work one shift of 6 hours in the 24 and have their time so arranged that once in each week they have a whole day free.

Before leaving the subject of opencast mines, it should be mentioned that the omission of a description of the most famous opencast mine in the Federated Malay States—the Tronoh—is not due to an oversight, but to the fact that permission to visit these workings was conditioned on a promise that a detailed description of the plant should not be published. The mine was formerly worked by means of shafting, but the overburden has now been removed and the workings are all opencast. Nearly 6,000 men are employed, and in 1911 the Tronoh broke all records by a production of 2,083 long tons of ore in four months.

NATURAL-POWER HYDRAULIC MINES.

Natural-power hydraulic mines are found in almost every section where a good supply of water can be secured under a gravity head of 100 feet or more, since by this method very low grades of tin-bearing earth can be profitably treated. There are included in this class the Tekka, Old Gopeng, New Gopeng, Kinta Association, and Kinta Limited, in Perak; the Serendah, in Selangor; and the Kenaboi and Seremban, in Nigri Sembilan. However, as the method of working and the plant employed are almost identical in every mine of this class a description of one will answer for all, and for this purpose the Tekka, the largest and best known, affords an excellent illustration.

The Tekka lies on the east side of the Kinta Valley, where the limestone substratum is pushed up into cliffs. The water supply is brought from the hills, under a pressure of 65 pounds to the square inch, and is distributed to the monitors through 10-inch riveted steel piping which has been tested to a pressure of 100 pounds per square inch. As these pipes are made in 20-foot lengths and are joined only by a taper joint, they are easily shifted. The monitors consist merely of steel pipes 6 to 8 feet in length and 4 to 6 inches in diameter, with a swivel joint and mounted on a wooden stand, the nozzle usually being 2 inches in diameter. There are now eight monitors in operation in the Tekka mine, utilizing a total of about 1,500 cubic feet (11,200 gallons) of water per minute.

The monitors cut down the tin-bearing earth and blow it up to the elevators through trenches prepared for that purpose. In the Tekka and most other mines of this class the deposit in these trenches is given a preliminary washing by hand, a large amount of ore being quickly and easily secured in this way. This washing is done principally by women, in slightly dished wooden trays, the drainage from the monitors being used for the washing. It should be noted here that in hydraulic mines no distinction is made between karang and overburden, as all the earth removed by the monitors is treated equally.

HYDRAULIC ELEVATORS—COST OF PRODUCTION.

The hydraulic elevators, of which there are two at Tekka, are for the purpose of raising the earth to the riffles, which must be sufficiently elevated to allow for the proper disposal of the tailings. These elevators are installed at the lowest levels in the workings, and a pit, or sump, is dug to receive the earth blown up by the monitors. The principle of the elevator is, of course, very simple, the earth being drawn up from the sump by suction, and carried to the top by the pressure of the injection water. As the injection water is under a pressure of about 65 pounds to the square inch, and the resulting erosion is considerable, the elevator pipes are made of cast steel, flanged and bolted. The height of the elevator depends principally upon the level of the ground on which the tailings are to be deposited, 30 to 50 feet being the usual elevation. While the mechanical efficiency of the hydraulic elevator is very low, this is of small importance, since the amount of water needed to wash a given quantity of earth in the riffles is almost the same as that required to raise the same quantity of earth through the elevator. The water is thus made to do the double duty of first raising and then washing the karang.

The riffles at the Tekka and other hydraulic mines are of exactly the same design and construction as those described for opencast mines, except that they are usually somewhat longer, since the karang, which the elevator discharges directly into the riffles, lacks the thorough preliminary sliming that a puddler provides. The final washing, drying, extraction of wolfram, packing, and smelting of the ore are the same in hydraulic as in opencast mines.

The low cost of working a hydraulic mine is best illustrated by a comparison of the Tekka with the Lahat mine. In the latter 700 men and 300 horsepower of prime movers (not to mention two locomotives) in 12 months raised 298,000 cubic yards of earth, of which 232,811 cubic yards were treated. In the Tekka mine only 300 men and no fuel-generated power were required to raise and treat an estimated quantity of 840,000 cubic yards in the same period. Estimates by the mine managers of the cost of raising and treating the tin-bearing earth in three different mines are as follows: Lahat (opencast), \$0.52 per cubic yard (overburden, not included, \$0.485); Tambun (opencast), \$0.34 per cubic yard; Tekka (hydraulic), \$0.07 per cubic yard.

Aside from a few coolies engaged in hand tramming, labor in the Tekka mine is paid by time; the Chinese receive \$0.335 to \$0.36 and Tamils \$0.205 per eight-hour day. In 1910, 438 long tons of ore were recovered.

GENERATED-POWER HYDRAULIC MINES.

Generated-power hydraulic mines resemble those of natural-power hydraulic mines in that the tin-bearing earth is cut down and blown to a central sump by monitors; but the water pressure must be generated by pumps and the earth raised to the riffles by gravel pumps, instead of by the hydraulic elevators used in the natural-power mines. The largest and most modern of the generated-power hydraulic mines is the Pengkalen, which is situated in the Kinta Valley, near Ipoh.

Its central electric station is equipped with three 400-horsepower Babcock & Wilcox water-tube boilers and two Bellis & Morcom's high-speed vertical compound condensing engines, each direct coupled to a 500-kilowatt dynamo from Crompton & Co., of Chelmsford, England, generating three-phase alternating current at 2,200 volts. Both Australian and Natal (South Africa) coals are used under the boilers. To increase the capacity of the plant, orders have recently been placed for a fourth boiler of 400 horsepower, automatic chain stokers for the whole battery of boilers, and a mixed pressure turbo-generator set of 600 kilowatts from Fraser & Chalmers (Ltd.).

The pumping station which supplies the monitors contains two single-stage 12-inch Worthington centrifugal pumps, each direct coupled to a 280-horsepower motor and having a capacity, at 740 revolutions per minute, of 3,000 gallons per minute at a pressure of

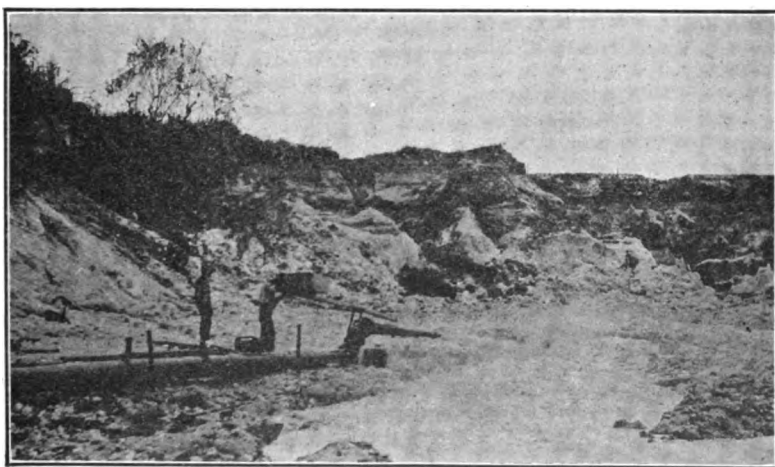


FIG. 4.—Monitor at Pengkalen mine blowing earth toward the intake of the gravel pump.

65 pounds per square inch. Six monitors with 2-inch nozzles are now in use, and the number will be increased as soon as the new power machinery is installed.

GRAVEL AND DRAINAGE PUMPS.

The third and most interesting division of the works are the gravel pumps, of which there are three in different parts of the workings. Each is placed upon a steel barge so that when the mine face becomes too distant the pumps can be moved to a new position by simply flooding one section of the mine and floating the barge to the desired point. However, as each movement of the barge necessitates changing the piping, and often the location of the riffles as well, a barge is usually shifted not more than once or twice in a year. Figure 5 shows one of these barges, covered over with corrugated-iron sheets. The pipe seen in the foreground is the intake of the gravel pump, while the discharge pipe, leading to the elevated riffles, is shown upon the right carried upon bamboo scaffolding. The total suction and discharge head is about 60 feet.

The Pengkalen gravel pumps, which are from the Australian Otis Engineering Co., of Melbourne, are 15 inches in diameter, with three-wing rotors 36 inches across. Notwithstanding that both rotors and liners are of cast steel (the former with cast-iron shoes) the erosion is so rapid that the life of a liner is usually not more than three months. The gravel pump is driven by a 12-strand wire-rope drive from a 350-horsepower motor, which is of Messrs. Cromptons' manufacture, as are all other motors in this mine. The suction and delivery pipes of the gravel pumps are 12 inches in diameter, of welded steel, flanged and bolted; the supply pipes for the monitors are the 10-inch riveted steel pipes with taper joints previously described.

The fourth division of the Pengkalen plant includes the drainage pumps, of which there are two, one 12-inch centrifugal with 85-horsepower motor and one 7-inch centrifugal with 20-horsepower motor. Another motor of 35 horsepower drives a 220-volt direct-current dynamo for lighting.

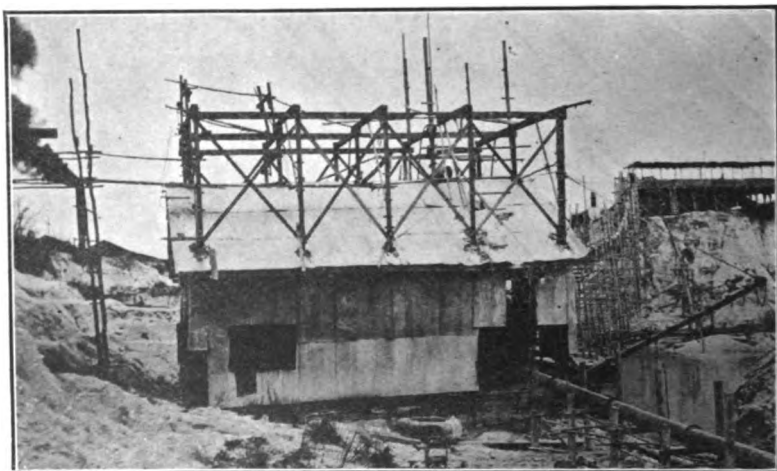


FIG. 5.—Barge carrying gravel pump at Pengkalen mine; raffles to the right.

OUTPUT AND COST OF PRODUCTION.

In the Pengkalen mine 776,000 cubic yards of earth were treated in 1910 for a return of 392 long tons of ore, but recently the working time has been shortened and the average treated is now about 30,000 cubic yards per month of 25 working days. Only 50 laborers are employed, most of them Chinese, who receive \$0.40 per eight-hour day.

The estimated cost of raising and treating the earth in this mine is about \$0.315 per cubic yard, nearly five times as much as in the Tekka natural-power hydraulic mine. This great difference, which is due to the high cost of steam-generated power as compared with natural hydraulic power, makes such plants as the Pengkalen out of the question on low-grade ground. It seems quite probable that lower costs might be attained in generated-power hydraulic mines by the use of producer-gas engines, or, even better, oil engines of the Diesel

or similar type. The Sungei Raia Co., of Perak, is operating a hydraulic plant driven by producer-gas engines using Chinese coal, but information regarding their costs is not at hand. So far as the writer can learn, there are at present no generated-power hydraulic plants in the Federated Malay States driven by oil engines.

The foregoing constitute the established methods of tin mining in the Federated Malay States. It is reported that a French company has placed an order for a steam dredge of the ordinary bucket type, to be used in Perak for tin dredging, but local engineers are skeptical as to the feasibility of this method, and it is not likely to be extended until the first dredge has had time to prove itself.

SMEETING.

The two plants which smelt most of the tin ore produced in the Federated Malay States are situated in Straits Settlements, one in Singapore and the other near Penang. There is also a small European-owned smelter in Ipoh, but owing to the noxious fumes given off its operation has been discontinued. Therefore, it may be assumed that all the block tin exported from the Federated Malay States is the output of Chinese smelters, similar to the one described in connection with the Tambun mine. This output of block tin is shown by the following figures from the reports of the Senior Warden of Mines:

Years.	Total export ore and block.	Block tin.	Proportion of block to total.
	<i>Long tons.</i>	<i>Long tons.</i>	<i>Per cent.</i>
1909.....	48,743.3	10,749.1	22.06
1910.....	43,865.0	9,780.7	22.29
1911.....	44,148.5	9,846.5	22.30

The total export figures represent 70 per cent of the gross weight of the tin ore, which is the proportion of pure tin to tin ore fixed by the Federated Malay States Government for taxation purposes.

It is said that over 80 per cent of the tin ore exported from the Federated Malay States is smelted either in the smelter of the Straits Trading Co. at Singapore or that of the Eastern Smelting Co. at Penang; these smelters also receive a small amount of ore from Australia and South Africa. Such of the Federated Malay States ore as is not smelted in the Straits Settlements goes to England, the following provision of the customs tariff making it impossible to ship the ore to other countries for smelting: "Export duty, tin ore, 70 per cent of the duty on tin with, in the case of tin ore exported otherwise than under such guarantees as the resident may require that it shall be smelted in the Straits Settlements or United Kingdom, an additional duty of Straits \$30 per picul (\$285 United States currency per long ton)."

The export duty on block tin, provided by the same tariff, is Straits \$10 per bhara (400 pounds) when the price of tin does not exceed Straits \$41 per picul; but when the price exceeds \$41 per picul the duty per bhara is increased by \$0.50 for every \$1 by which the price of tin exceeds \$41 per picul. At the present (Feb. 22, 1912) price of

Straits \$96.50 per picul in Singapore, the export duty amounts to Straits \$38 per bhara, or \$109.25 United States currency per ton of 2,000 pounds. In 1910 this duty alone yielded the very handsome revenue of \$4,002,668 United States currency.

CHARGES FOR SMELTING.

The smelting companies buy the ore outright from the producers, after the quality has been determined by assays made at the mine by the smelter's assayer. The charge for smelting can, therefore, be quite accurately estimated from the difference between the price which the miner receives for his ore and the market price of block tin on the same date, the percentage of tin in the ore being known. The managers of four mines gave the following as their charges for smelting, the term being used in the sense explained above:

Mines.	Charge per picul.	Charge per short ton.
	<i>Sta. dolls.</i>	
A.....	2.37	\$20.11
B.....	2.16	18.19
C.....	2.32	19.66
D.....	2.24	18.98
Average.....	2.27	19.23

The difference in the charge for different mines is partially explained by the fact that the price paid the owner is usually for the ore delivered at the nearest railway station, the smelting company paying freight charges to the smelter. The published railway tariff for tin ore is one-half cent Straits currency per mile per picul for the first 50 miles, and one quarter cent per picul-mile for each subsequent mile up to 150, after which it becomes one-eighth cent per picul-mile for each subsequent mile. Therefore mine A, which is, say 122 miles from Penang, will find its smelting charges 10 cents per picul higher than mine B, which is, say, only 82 miles from Penang. Assuming the distance from Ipoh to Penang (112 miles) to be the average distance the ore has to be shipped to the smelter, then the smelting company's gross profit is at once reduced by 40½ cents Straits currency (plus wharfage charges at Prai) per picul, leaving \$1.80 to \$1.90 Straits currency for the actual cost of smelting, marketing, and profit. At the present price of tin, \$96.50 Straits per picul, this net charge amounts to 1.8 to 2 per cent of the market price of block tin.

LABOR CONDITIONS.

The table on page 8 shows that the total labor force in the Federated Malay States tin mines in 1910 was 170,361, a decrease of 14,340 as compared with 1909. In 1911, however, the labor force totaled 196,300, a considerable increase over any previous year. In addition to the number given, 10,257 women and children worked in the mines in 1910 under "dulang" passes issued by the Government, but as their employment is not continuous they are not included in the regular labor force. The number employed under various

systems in 1910 was as follows: Contract, 47,480; wages, 22,921; tribute, 99,960; dulang, 10,257.

Under the contract system the laborers receive, either direct from the mine manager or from the Chinese foreman who employs them, a fixed amount for each truck of karang or overburden raised from the mine, as in the case of the Tambun and Lahat mines. This system has been found much more satisfactory for mine coolies than a fixed daily wage, since it prevents "soldiering." On the other hand, it is obviously impossible to fix a contract rate for mill hands or for the laborers in hydraulic mines, hence they must be paid by time.

At the height of the tin boom in 1906, when tin was selling at \$860 United States currency per long ton, the general eight-hour wage for Chinese laborers reached \$0.51, but during the heavy slump in price which followed in 1907-8 the mine owners, by unanimous action, cut this rate to \$0.34. With the steady increase in the price of tin since 1908 wages for both Chinese and Tamils have gradually increased until, as has been shown, the present eight-hour wage in European-owned mines ranges from \$0.34 to \$0.40 for Chinese and from \$0.225 to \$0.26 for Tamils. This increase has been partly due to the growing demand for labor on the rubber estates, but this demand has not affected the supply of mine labor so much as would be expected, since the rubber planters find Tamil labor more suited to their requirements than Chinese and usually arrange to obtain Tamils direct from India instead of attempting to draw them from the mines. The Chinese find that they can, as a rule, earn more in the mines than on the estates, and consequently only a few, who are required for such heavy work as felling, clearing, and trenching jungle land, are to be found in the rubber districts. These few are usually working on the contract system under a Chinese contractor and receive about the same pay as mine coolies.

It may be mentioned that wages in Chinese owned and managed mines are often 10 to 15 per cent less than in European mines. To some extent this may be due to a natural preference of the Chinese coolies for working under superintendents and managers of their own race; but it is generally said that many Chinese mine owners hold their coolies by a debt bond, arising from loans and advances, which the coolie finds it almost impossible to discharge, and must remain, even when higher wages are offered him elsewhere. The conditions in the Chinese mines are undoubtedly better to-day than formerly, owing to the efforts of the Protector of Chinese, an officer under the Federal Government, but owing to illiteracy and ignorance among the coolies these abuses can not be entirely prevented.

TRIBUTE SYSTEM.

The foregoing figures show that 55 per cent of all the labor in the tin mines in 1910 was working under "tribute," and it is estimated that 65 to 70 per cent of all ore recovered is won by this method of labor. Tribute is the local term for "working on shares." The holder of a mining lease often avoids the risk incident to working his property by allowing individuals, or a Chinese employer of labor, to work the mine upon payment of a fixed percentage of the ore recovered. The percentage depends, of course, upon the richness of the deposit and the ease or difficulty of raising and treating the

karang. In almost every mine the dumps and tailings are worked over by tributers, who pay 10 to 15 per cent of their profit for the privilege. The popularity of tribute working with the Chinese lies in the fact that, though it may not pay so well in the long run as a fixed wage, there is always the possibility of striking it rich. The principal objection to tribute working is that antiquated methods are usually employed and the lower grades of karang disregarded. It is obvious that a tribute worker whose very success may lead to a cancellation of his privilege or to the exaction of an unreasonable tribute is not likely to install modern machinery or treat low grades of tin-bearing earth in a property belonging to another. Therefore it may be said that the decrease of 14,000 in the number of tribute laborers in 1910 as compared with 1909 is an indication of the adoption by mine owners of improved methods and more machinery, an indication which is supported by the fact that the total horsepower (steam, gas, and hydraulic) employed in the tin mines in 1910 was about 10 per cent greater than in the preceding year, reaching a total of 18,515 horsepower.

TAMIL AND OTHER LABOR.

Over 75 per cent of the hands now employed in the tin mines are Chinese, the remainder being principally Tamils, with some Malays, Javanese, and Punjabees. The Malays are usually employed only as mill hands and machinists, and the Punjabees as watchmen. On the rubber estates many of the Javanese laborers are indentured for a fixed term, but those employed in the mines are all free labor.

The amount of Tamil labor in the tin mines is steadily increasing, as it serves to supply a deficiency in Chinese labor and thus prevents a demand for any considerable increase in wages. These Tamils are recruited from the Madras Presidency of India, either by the miner's own representative (holding a Government license) or by the representatives of the Immigration Committee, a body appointed by the high commissioner of the Federated States. The Tamil immigration fund enactment provides that to meet the expenses of recruiting, to provide free transportation of the Tamils and their families to the Federated Malay States, and to maintain a home for decrepit Tamil laborers, every employer of Tamil labor in the Federated Malay States shall be assessed once in three months an amount not exceeding \$1.70 United States currency per quarter for each Tamil laborer in his employ. Furthermore, the act provides that if the returns which the employer is required to make show that the number of Tamil laborers in his employ is greater than the number for which he has provided free passage from India in the two preceding years, a further assessment may be levied for each laborer in excess; the total assessment, however, may not exceed \$1.70 per quarter for each Tamil employed. For the last two quarters of 1911 the rate levied was \$1.135 under the first section of the act, and a further charge of \$0.565 under the second clause.

COAL DEPOSITS.

In conclusion, mention should be made of the fact that coal deposits have recently been found near Rawang, in the State of Selangor, which it is hoped will prove of value. The specimens obtained

from the trial workings are a low grade of hydrous lignite, but the quality may improve at greater depths. The Rawang Federated Malay States Coal Syndicate (Ltd.), with a capital of £25,000, has been registered in London to develop this field, though it is understood that the Government of the Federated Malay States will retain a controlling interest.

LIST OF DEALERS.

The class of machinery and supplies for which there is a market in the mining district of the Federated Malay States is indicated in the foregoing report, and manufacturers desiring representation there can secure from the Bureau of Manufactures a list of the houses dealing in mining supplies and a confidential circular dealing with immediate trade prospects and methods of entering the market.



